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S. A. Sugar Association.

PROCEEDINGS OF THE

THIRD ANNUAL CONGRESS

HELD ON

MARCH 25th, 26th & 27th, 1925.

AT

UMBOGINTWINI, MOUNT EDGECOMBE & DURBAN.

Published by the South African Sugar Association, 334, Smith Street, Durban, Natal.

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Sth. African Sugar Association.

Third Annual Congress.

MARCH 25th, 26th and 27th, 1925.

Record of Proceedings.

The functions connected with the third Sugar Week held on the 25th, 26th and 27th March of this year, although on a small scale, possessed the merits of being, according to their limitations, highly successful, the days being full of useful work and yielding the maximum of valuable information and discussion.

Unfortunately the days set apart for the Congress were during the abnormal period of rainfall and the first day at Kynoch's was especially dispiriting, the rain falling in torrents when the party arrived at Kynoch's siding.

The second day at Natal Estates was fine, although owing to the exceptionally heavy rains which had fallen throughout the whole of the previous night, the soil was very muddy and the roads on the Estate almost impassable, consequently a severe curtailment of the programme was necessary. It was necessary to abandon the visit to Umhlanga Rocks owing to the impassable state of the roads, but perhaps it was as well, as the day's programme was sufficiently congested without taking in some of the features.

The third day at the Durban Town Hall was full of interest to everybody and produced some very excellent information dealing with the technical side of the planters' existence. There was almost a complete absence of information relating to the manufacturing side of the Industry, which is a decided disadvantage, as a Sugar Week confined entirely to planters' problems is catering for only about one-half of the Industry. Incidentally the attendance was confined almost exclusively to planters, but the conditions of the roads undoubtedly had a good deal to do with this.

Communication with the South Coast, by road, was completely cut off owing to the flooding of the Umlaas river, adjacent to Durban, while on the North Coast, although the main road was not in a very bad state, yet the planters were unable to get away from their homes with their motor cars owing to the state of the by-roads and those who did attend from any distance were perforce obliged to go by train. These are circumstances over which nobody had any special control, and it is gratifying to be able to record that in spite of these drawbacks the three days were spent to great advantage.

AT UMBOGINTWINI

It was rather a cheerless morning when the people assembled at the Durban railway station for the trip to Umbogintwini. Many of the familiar faces seen at the previous Sugar Week were missing. Cedara had sent a strong force of experts in Mr. Fisher, Mr. Williams and Mr. Edelman, while there was Mr. Dodds, the Director of the Sugar Experiment Station, Mr. Storey, the Government Mycologist, whose speciality at the moment is Streak disease, and Mr. Schwikkard, Experiment Station Farm Manager.

The first day at Umbogintwini was the outcome of a generous invitation put forward by the African Explosives & Industries, Ltd., better and more popularly known as Kynoch's. On arrival at Umbogintwini the rain was pouring down and everybody took shelter in a large open shed, and for several minutes the weather seemed to defy their efforts to move, but the uninviting aspect was ameliorated by the momentary cessation of the rain, but it was evidently impossible to make a tour of the fields under such conditions and accordingly it was decided to move off to the Social Hall, the run being made in motor cars, buses and a huge char-a-banc. On arrival at the hall everybody was made welcome.

The members of the Congress gathered around the spacious billiard room and Mr. O. J. Johnson, as Chairman of the day, took charge of the proceedings. Having regard to the condition of the weather it was decided to alter the time of the programme so as to be in a position to inspect the demonstration plots in the event of the weather clearing. Mr. C. O. Williams, chief chemist at Cedara, began the practical work of the day with the reading of a paper entitled "The Purchasing of Fertilizers."

THE PURCHASING OF FERTILISERS.

(Paper by C. O. Williams, Chief Chemist Cedara School of Agriculture.)

In a paper read before the Sugar Congress two years ago I dealt with the question of manures in a general way, and other papers on the programmes of the last two Congresses have also treated on this question of manuring. It is therefore my object in this one to deal with only one particular aspect of it, and that is the economical purchasing of fertilisers. This has been gone into fairly fully by me in an article published in the Journal of the Department of Agriculture a few months ago and my discourse to-day will be merely informal and somewhat cursory.

It is supposed, in the first place that the farmer has satisfied himself as to the need of fertilisers for his land and the constituents required. This is a very important matter for many a planter adds needlessly to the cost of production of his crop by applying unnecessary fertilising materials or the wrong form. Again, by leaving out a very essential constituent he may render futile the application of other ingredients, for by the law of minimum the growth of the cane crop would be governed by the amount of that fertilising constituent in the soil which is most deficient. For instance, if the soil is lacking in potash no amount of phosphatic fertilisers applied to the soil will increase the growth of the crop until that potash deficiency is also made up.

False Economy.

When the planting season is drawing nigh I can imagine that the farmer becomes forcibly aware of it by the number of fertiliser catalogues he finds in his post bag at that particular time of the year. I am afraid that many of our farming friends have not sufficient knowledge of this question to study these catalogues to the best advantage, and very often may choose a fertiliser because it is the cheapest per ton, for instance. Others may allow themselves to be persuaded by the specious arguments of the charming young man who calls upon them on his firm's behalf. It is not my intention, however, to insinuate that there are fertiliser firms in this country who deliberately try to hoodwink the agricultural community in this respect, but nevertheless it is very essential that the farmer should have sufficient knowledge of this matter to scan fertiliser catalogues intelligently, and to be able to hold his own when it comes to interviews with trades representatives.

The three elements most often not found to a sufficient extent in an available form in the soil for the needs of the crop are nitrogen, potassium and phosphorus, and the commercial value of a fertiliser is generally calculated as depending solely on the quantities of these three elements present in it. With regard to the element potassium it is the equivalent amount of its compound with oxygen i.e., potassium oxide or potash, that is always estimated, and similarly with regard to phosphorus it is the corresponding amount of phosphoric oxide that is taken into consideration.

System of Unit Values.

From what has been stated it follows that when analysing a fertiliser we usually estimate the percentage amounts of nitrogen, potash and phosphoric oxide in it. One per cent. of a ton (i.e. 20 lb. in actual weight) of any of these constituents is taken as a unit for the purpose of valuation of that particular constituent. It is not proposed in this paper to explain how this unitary method is applied in fixing the fair average commercial value of a fertiliser and if anyone should find that he is not sufficiently capable of making use of the table of unit values provided, for the purpose of comparing the commercial values of the various brands of fertilisers quoted to him by different firms and thus ascertaining the best bargain offered, we shall always be pleased to assist him provided he sends the necessary particulars to us.

It is not claimed that this system of valuation of fertilisers is perfect, for in drawing up the list of unit values certain assumptions are made which may be rather far from the truth, but we may claim that it is on the whole fairly reliable and certainly serves a useful purpose.

Precautions to be Observed.

If the catalogues of the various fertiliser dealers for the present season are scrutinised, and the prices compared on the system advocated above, one will soon realise that there is often a marked difference in the value offered, and this is particularly the case with the so-called mixed or compound fertilisers. As stated at the outset, a farmer is often only too ready to look at the price per ton and does not pay sufficient attention to the composition of the fertiliser. In order to keep the price per ton down a manufacturer will sometimes add a cheap or worthless ingredient to his mixture, and even if this low grade fertiliser were sold as cheaply, comparatively, on a unit basis, as high grade ore, it would still be not as good a bargain, for the farmer would have to pay more in railage, cartage and handling, on the same amount of true fertilising material As a rule, however, the price per unit of a constituent in a high grade fertiliser is lower than in a low grade one even if the total price per ton of the former may be often considerably higher.

The Purchasing of Fertilisers.—Contd.

It is generally found that in the case of the simple or one-constituent fertilisers the unit values do not vary a great deal according to the prices quoted by most firms for any particular class of fertiliser. For example, in the case of the several brands of sulphate of potash on the market the price of potash per unit does not differ by a large amount. This, however, is by no means an invariable rule, and even when purchasing simple fertilisers it will be often found that some firms offer a much better bargain than others.

Mixed Fertilisers.

But it is with regard to the mixed or compound fertilisers, however, we find that the greatest differences appear, and speaking generally one may state that the prices asked for fertilisers of this nature are in a large number of cases comparatively too high, that is, as compared with the prices of the simple fertilisers of which they are composed. When valuing a mixed fertiliser the sum of 10/- per ton is allowed to the dealer to cover the cost of mixing and re-bagging the several ingredients, which is considered to be a fairly generous figure. (Incidentally, it may be pointed out that the question of cost of bags does not come in here at all, as some occasionally try to argue, for in valuing the simple fertilisers the cost of the bags is allowed for and the same number of bags are used for a mixed fertiliser as for the simple fertilisers making it up).

I should not go to the extent of stating that farmers should always buy their simple fertilisers separately and from them make up their own mixtures, for there are a large number of cases where the mixed fertilisers are sold at a reasonable figure, and, moreover, the farmer gets the benefit of having his mixtures made much more thoroughly and uniformly than is possible for himself to make them, and such a ready-made mixture saves him a great deal of trouble. One point to bear in mind is this, that he should not buy a mixture which is unsuitable for his purpose or which contains an ingredient which his soil may not require. For example, it has been found by experiment that application of a nitrogenous material is often unnecessary and may even depress the yield, and since it is the most expensive constituent per unit of all, he could often cut his fertiliser bill down very considerably, and with advantage perhaps to his crop, if he bought a mixture that did not contain this constituent at all.

Fertilisers That Will Not Mix.

Should a farmer decide upon mixing his own fertiliser then he should bear in mind that there are some materials that will not bear mixing with others without causing loss or deterioration. To give a few instances:—

1. Superphosphates and other fertilisers containing water-soluble phosphate should not be mixed with any material containing free lime or even with carbonate of lime because the water-soluble phosphate gets reverted to a less soluble form.
2. Mixing sulphate of ammonia with lime materials causes loss of ammonia.
3. Mixing nitrate of soda with very acid materials like double superphosphate or even a damp superphosphate will cause nitrogen in the form of nitric acid to escape.
4. Mixing potash fertilisers with lime materials will gradually produce a hard, lumpy mixture difficult to sow.

It may be mentioned, however, that in most cases if the mixture is applied to the soil very soon after it is made up no very appreciable loss or deterioration takes place.

The Fertilisers Act.

This Act was placed on the Statute Book in order, primarily, to protect the farming community, but incidentally it also protects the honest fertiliser dealer against unfair and dishonest competition on the part of an unscrupulous dealer. Regulations have been drawn up under this Act and have been in force for several years, and copies of them may be obtained through the usual channels, if desired. The gist of some of these regulations I should like to put before you:

1. Every importer, local manufacturer, or dealer in fertilisers must register every kind he imports or manufactures under a definite brand, giving also the necessary particulars as regards composition, etc. These particulars the dealer must supply to the buyer under a guarantee whenever a sale is effected, and the latter should carefully see that this warranty is received by him before taking delivery.

2. Every bag must be marked with the brand of the fertiliser, and in the case of some of the more important simple fertilisers the proper grade and the percentage of the constituent must also be shown. For example, "Superphosphate: X Brand: Medium High Grade: 16.8 per cent."

3. Basic Slag, raw and treated phosphate rock and the various raw bone products must be guaranteed to be within certain degrees of fineness as laid down in the regulations, for the availability of these fertilisers depends largely on their fineness.

4. All guanos and mixed fertilisers must contain specified minimum amounts of the usual fertilising constituents (i.e., nitrogen, potash and phosphoric oxide).

5. All raw bone products must be certified as having been efficiently sterilised.

An Important Point.

6. If a farmer has reason to suspect that the fertiliser is not what he ordered or is not up to the

The Purchasing of Fertilisers.—Contd.

standard given on the guarantee, and wishes to have the fertiliser analysed, he should not take delivery of the consignment from the railway authorities. The sampling of the consignment would have to be carried out at the railway station, under the conditions laid down in the regulations, and the fees for the analysis of the sample are also given in the regulations. Sometimes, farmers send to us samples of registered fertilisers to be analysed some months after the sale has been effected, but we are precluded by the Departmental regulations from carrying out the analysis of such samples, and in any case the farmer would have no redress under the Act even if the composition of the fertiliser was found to be appreciably below the guarantee. It may be pointed out here that all imported fertilisers are sampled at the port of landing and sent to a government laboratory. Also periodical sampling is carried out of fertilisers manufactured or made up in the Union, so the farmer is fairly well protected in this matter, and it is not often he would find that his fertilisers are markedly below the guaranteed composition.

We often find farmers blaming the fertiliser if they do not find their crops coming on as well as they expected, but there are a large number of reasons for the failure of a crop besides a worthless fertiliser as I have tried to show in the paper read before you two years ago.

In conclusion it may be stated, for the information of all agriculturists, that these same regulations also apply, with the necessary changes, to the sale of farm foods.

QUESTIONS.

Mr. D. L. Patrick asked a question with regard to "fillers" mentioned by Mr. Williams. If one had a very rich fertiliser ingredient which occupied a very small space surely it would be easier to distribute it if it was mixed with something else, particularly if mechanical means were used to distribute it. In such case he considered it was necessary to have a "filler."

Mr. Williams replied that some fertilisers were so damp and sticky that it was essential to have some drying agent to mix with them. But with mixed fertilisers very often one ingredient dried the other and there was no need for a filler; nevertheless it was very often put in by manufacturers. In any case if it is necessary to mix fertilisers before applying to the soil, he thought it would be better for the farmer to do that himself.

Attention was then drawn to the fact that in such event the question of time, facility, and labour came in. Would it not be better to have it mixed under technical supervision rather than do it on the farm.

Mr. Williams replied that that was a question for the farmer himself to decide. He could assure them that the prices asked for some of these mixed fertilisers were such that he thought it would pay almost any farmer to make his own mixtures. In this connection, however, he was not referring to mixed fertilisers in general.

Mr. W. V. Blewett then addressed the members present as follows:—

"I would like to make a few remarks. Mr. Williams in his opening remarks seemed to be rather apologetic at coming here to read a paper on the purchase of fertilisers! As a matter of fact some of the staff suggested that we should put a notice up "Do it Now" and I don't think there is any need for Williams to be apologetic about it. (Laughter). Then I began to be afraid, when he was talking about some fertilisers not being much good, that he might be going to denounce fertilisers generally. However, there is no doubt that Mr. Williams has laid down the correct lines on which fertilisers should be bought and there is very little doubt that to-day with the protection of the Fertiliser Regulations the planter is getting a better product than he did a few years ago. It is agreed pretty well everywhere that fertiliser should be used, and what is wanted is more experimental work to decide which is most economical to the planter. Obviously every planter with different soils will not require the same fertiliser.

With regard to the question of "fillers" nowadays it is not possible to charge the planter for something which is merely a filler; at least it is not possible if he keeps his eyes open. If he is led away by some representative he must of course pay a price higher than that based on the unit price of the fertiliser. But if a filler has no plant food obviously it is easy for the planter to value that fertiliser, and he need not pay for anything that is a filler. I agree that it is very often necessary to have some "driers" but they should not be classed as "fillers." A filler obviously cannot be charged to the planter if he buys with his eyes open.

There is another difficulty which fertiliser manufacturers have to face. They are called on to make up a big range of fertilisers, chiefly for reasons of competition. You see all sorts of "specials" and it is becoming the practice in countries where fertilisers have been used for long periods to reduce the number of those "specials." There are various things which have to be taken into consideration in connection with the valuation of the different fertilisers. It costs just as much to bag a low grade as a high grade fertiliser, and the tendency is to sell higher grade fertilisers year by year for the reason that the cost of mixing, bagging, handling and transport are all reduced in the high grade fertilisers.

Mr. Munks stated that he had been in the habit of using bone dust on all his soils, in mixtures and alone. He wished to know if he was doing right or wrong.

The Purchasing of Fertilisers.—Contd.

Mr. Williams replied that bone dust was a very safe fertiliser to use, either alone or as a mixture. It would suit various types of soils and it also bore mixing with almost any other fertiliser.

A gentleman asked Mr. Williams a question as follows: Some farmers kept a number of cattle and had quantities of kraal manure which was very strong in nitrogen, had a great deal of humus, and was beneficial to the soil, but the soils generally were deficient in phosphates. How could that kraal manure be improved to make it suitable for cane lands generally?

Mr. Williams replied: Kraal manure is particularly deficient in phosphates, but as a rule if you mix kraal manure with some phosphatic fertiliser you have an ideal fertiliser for most soils and crops. They tell you of course that you should not mix with kraal manure any substance that contains free caustic lime, and for that reason it is stated that it is inadvisable to mix basic slag because it contains free lime, but I think even in that case if you apply the mixture straight away, in practice there is not much harm done. But you can mix any of the other phosphatic fertilisers with it. Per unit of phosphoric oxide present, mineral phosphates of course are cheaper than the others, and it becomes very quickly available when it is mixed with an organic fertiliser like kraal manure, especially if there is enough moisture in the soil. So that personally I think it is the ideal substance to add to kraal manure. The objection I have to bone meal is its price, otherwise it is very effective.

A question was asked as to what Mr. Williams had found to be the greatest deficient in plant food in the numerous samples of soils which he had analysed from time to time from the sugar belt.

Mr. Williams replied that speaking generally the heavier soils; the vlei soils, were fairly rich. If they did require anything it was usually phosphates. Some of the heavier hillside soils could also do with potash as well, especially for cane, but the sandy soils which were almost the predominant type on the Coast could do with the three ingredients. With regard to nitrogen he thought the experiments which had been carried out at Winkle Spruit showed that the organic form of nitrogen was the best to use, but it also paid to apply both potash and phosphates.

Mr. Munks stated that he always understood the application of phosphates to soil which was sour would be inclined to make the soil more sour.

Mr Williams replied that the type of acid phosphates usually sold were the superphosphates, including the double superphosphates. The water soluble phosphate itself was acid by nature, and in the manufacture sulphuric acid was used and there was generally a small amount of that over free in the superphosphate, although he could say that of some samples taken from both foreign and local manufacture they had found less free acid in the superphosphate of local manufacture than in the imported article. The amount that was added to the soil in any event was very small, especially with the coast soils which were sandy by nature and with very free drainage, and with a good rainfall there was no need to worry about the amount of acidity.

Mr. Patrick referred to certain chocolate soils and asked if superphosphate was applied to chocolate soil what effect the phosphoric oxide had on the soil.

Mr. Williams in reply stated that that was a rather important point. As a matter of fact they had been carrying out investigations on the point at Cedara for the last two or three years. The soil at Cedara was of the chocolate type, very rich in iron oxide, in fact they could look upon some of the soils there as low grade iron ores. They had found that the water soluble phosphate was changed into an insoluble form. In the Midlands it had been found that a mixture of superphosphate and bonemeal was better than superphosphates alone and that was a favourite mixture with farmers. It had been found by practice that this reversion of the superphosphate did take place although the water soluble phosphate was very useful indeed as it was so rapidly available to the crop when pushing on a crop in the young stage.

With chocolate soils it was not a bad practice to put a certain amount in the mixture for that purpose because phosphates played a good part in the pushing on of young crops. If it was found that superphosphate was undesirable by itself the question was often raised, what other fertiliser could be mixed? There were various fertilisers which could be used instead; bonemeal was an excellent one on that type of soil, and so was basic slag. But the objection to bonemeal was its price. If the soil does not require nitrogen, by buying bonemeal one would be paying at least a third of the cost of the fertiliser for nitrogen.

With regard to mineral phosphates they had found this to be a very useful fertiliser in the chocolate soils. So far they had not published any authoritative data as they wished to carry out these experiments for a few years before doing so, but he was in great hopes of being able to use mineral phosphates on this class of soil. It could be mixed with superphosphate and applied immediately to the soil without much damage.

With regard to the point raised as to whether it was not better for fertilisers to be mixed by the manufacturers, personally he thought it was a better practice to buy them separately and to mix them on the farm and apply to the soil immediately. By so-doing they obtained the benefit of the water soluble in even distribution through the soil before any reversion, or very little at any rate, took place between the two fertilisers. If, however, a farmer

The Purchasing of Fertilisers.—Contd.

found he could not mix the fertilisers economically on his farm then he did not see any great objection to buying the mixture ready made.

At the conclusion of his remarks Mr. Williams was loudly applauded, and the Chairman thanked him on behalf of the members.

STREAK DISEASE EXPERIMENTS.

At this stage the weather having cleared up somewhat it was decided to proceed to No. 1 "Hill" Plots where Mr. Storey explained, through the medium of a wireless broadcasting set and loud speakers placed in the field, the nature of the various plots. These plots were planted on March 15th, 1924, with cane cut from a single field.

The condition of these plots at four months old was shown in a photograph recently circulated to members. Exceptionally severe secondary infection had occurred and all plots were fully diseased with Streak, although some of the plots had been originally planted from healthy setts.

The plots were most interesting, as they plainly demonstrated the extraordinary spread of Streak disease. But the important feature of the demonstration was the answer to the question: What effect has Streak disease on tonnage? Only weighing tests will prove this conclusively and these will be carried out in due course. From appearances, however, it was plain that the cane which started undiseased was easily better than that which started diseased. A plot of heavily infected mealies which had been planted late in the season also gave rise to a good deal of discussion as to the spread of disease being assisted by the growing of maize in the vicinity of cane.

In close proximity to the cane plots an experimental plot of Sunn Hemp (a green manure) was seen, but this was of exceptional height as the plants had been allowed to grow for the purpose of obtaining seed. When ploughed in at the proper stage this plant is claimed to be a good green manure for coast soils.

THE LUNCHEON.

The members then proceeded to the Social Club where a most excellent luncheon had been prepared by the ladies of the staff, and to which the members had been invited as the guests of The African Explosives & Industries Ltd. The ladies had worked very strenuously to make the lunch a success and everything was greatly appreciated.

After the loyal toast the Chairman rose to propose the toast of "The African Explosives & Industries Limited," coupled with the name of Mr. W. V. Blewett, as follows:—

"It falls to my lot to propose the toast of our hosts, and with that I couple the name of Mr. Blewett. I wish to say how pleased we are with the entertainment they have given us to-day. In going round the various fields, and looking at the different experiments, we can see that there is someone alive even if, as some think, we have been dead ourselves. (Hear, hear). Someone is doing the work to show us how to grow cane under the best conditions and get the best results. When we see all that is being done one sometimes wonders whether it is really necessary for us to get an experimental station ourselves! Of course they may be doing it for an ulterior motive! (Laughter). Perhaps they want to show us how to grow 60 tons to the acre. If they can do that then I am sure we will all be only too pleased to get their fertilisers."

Mr. Blewett in rising to reply, said:—

"I feel rather guilty in rising after the very excellent reception you have just given me, especially as I have really done less than anybody in connection with the work and the arrangements made to see that you were properly entertained. I have been away during the last two or three weeks and the other members of the staff, especially the ladies (hear, hear), have been working hard to see that Umbogintwini kept up its reputation for hospitality. When I came back and wanted to butt in they said "there is nothing for you to do, its all fixed up." I won't mention anyone by name but I take this opportunity of thanking those who have done so much to ensure the success of to-day, and I hope that we have shown you all how welcome you are.

With regard to Mr. Johnson's remarks I may say that when we started putting down experimental plots it did not enter our heads that the South African Sugar Association as an association would be interested sufficiently to come out here in a body. We thought that individual members might come along to see things for themselves, but we had no idea of being honoured in the way we have been to-day. The beginning as regards cane experiments was that Mr. Storey was out here and talking about doing some experimental work in connection with Streak disease, and we offered to do it here. We offered our help by doing anything he could suggest. Then he started first on one soil and later on two other soils, to put in these Streak and healthy plots for the purpose of arriving at some idea as to the effects and growth and the treatment of this Streak disease. It is to be hoped that those results will be useful.

Although I have no doubt Mr. Storey could speak with confidence on several points, undoubtedly this sort of work will ultimately enable you to make certain definite statements and lay down certain rules which will enable you to increase your tonnage per acre. (Hear, hear). Later on Mr. Dodds came down and we said the same thing to him, that we would help in any way with regard to experimental work he wished to carry out, and we arranged various green manuring plots and so on. Both Mr. Storey and Mr. Dodds know, whether the work we do is advertised or not, we are quite prepared to investigate from the scientific point of view wherever we have the facilities.

The Purchasing of Fertilisers.—Contd.

We have other plots here—the fertiliser plots—and as Mr. Johnson said one might question our motives in that connection. (Laughter). We did that for the sake of the staff here. Several of the staff were anxious that we should put down experimental plots here instead of elsewhere as we have been doing in the past, so that they could see the effect of certain fertilisers of which we were inclined to speak rather flamboyantly. We had no idea when we started those plots that they were to be demonstration plots. Mr. Dodds knew what was happening in regard to that, but they were put down for our own experimental work. If there is one thing that we believe in here, it is that scientific work is of value to all agricultural and industrial interests of this country (hear, hear), and because of that we like to do that work here. We are in touch with the Government officials at Cedara and other officials in this country, and we are anxious to get to know about the growing of crops and the treatment of crop diseases and so on.

I think that men like Mr. Dodds and Mr. Storey are entitled to the enthusiastic support of all the people in the Sugar Industry. (Hear, hear). I say that as an outsider in so far as the Sugar Association is concerned, but that is the feeling which I hold very strongly, that they ought not to get reluctant but enthusiastic support. For your own sakes quite apart from anything else, money spent and time devoted to scientific work and increasing our knowledge of the crops we grow, is going to come home multifold before very long (hear, hear), and there is no doubt that the Sugar Industry must get a "push" from somewhere. Under our present conditions we ought to be very dissatisfied with the yield per acre in Natal and Zululand, and I think a slogan such as "Thirty tons per acre" ought to animate the whole of you people. (Loud applause).

Mr. Johnson the Chairman then proposed the toast of "The Ladies," saying they could not be too grateful to the ladies for the way they had catered for them. They had done splendidly.

Mrs. King suitably replied on behalf of the ladies, and said that they were all very proud of their village and the products of the factory, but from the housewife's point of view they were also very interested in the price of sugar. By using more of their fertilisers she felt sure they would increase their crops of cane and so reduce the price of sugar. (Applause).

PLOTS ON THE FLATS.

After lunch, although it was still raining slightly, the party proceeded to inspect the Flats plots where various experiments had been carried out with fertilisers on healthy and diseased cane and other crops. Here Mr. Blewett explained the nature of the various experiments to a deeply interested audience. Everything had been done in the most scientific way so that results might be reliable when obtained. The visitors saw the plots at an interesting stage and in due course will receive reports on each experiment as it is completed.

Thereafter the party returned to the Social Club where tea was served and the programme continued.

BEST METHODS OF APPLYING FERTILISER.

In replying to the question (No. 5): "What method is considered the best in applying fertilisers?"

Mr. Blewitt stated:—

That question has interested us considerably during the last year or so, and there is no doubt that the results of fertilising very often prove inconsistent owing to the method in which the fertiliser has been applied. This morning you saw the healthy and Streak plots on what we call the "Hill" site. There you have a light sandy soil and we wanted to give certain of those plots the best chance by giving them a heavy dressing of fertiliser, so that we could see the effect of Streak growing with and without fertiliser.

The whole of that plot had a dressing of fertiliser some few months ago when we were growing tobacco there, but the tobacco crop proved a failure. Half of that had a heavy dressing of mixed fertiliser, applying 1000 lbs. to the acre, and applying the fertiliser in contact with the setts of cane, and we were surprised to find that the cane which was unfertilised came up quicker than the fertilised cane and was for quite a time certainly of stronger growth. I think it is only now that the fertilised cane is gaining on the other, but the set-back then was very marked. It is of common knowledge with small seed, say cabbage seed, that the effect of fertiliser may be harmful if they are intimately mixed, but we did not think it would be so marked in the case of cane.

We went into the matter in connection with crops such as cotton monkey nuts, and maize, and planted many thousands of seeds of the various crops and applied fertiliser in different quantities both in immediate contact with the seed planted by hand, and also putting the fertiliser under and above the seed, and away from the seed. The result certainly has been very interesting. There can be no doubt that in a dry season harm can be done to most of our crops by applying the fertiliser in contact with the seed or setts as the case may be, whereas in the wet season those results would not happen. With very heavy rains it would not make very much difference if the fertiliser was in contact with the seed or not. But we have had extremely heavy rains recently which we cannot take as normal conditions. I mention this point in connection with the answer to the question which has been put.

Fertiliser can be broadcast. Broadcasting I think is an excellent method; it is quite sound and safe. It is perhaps difficult without proper machinery to give an even distribution of your fertiliser but

The Purchasing of Fertilisers.—Contd.

there is no doubt about the safety of that method. If you are using a fertiliser which in this weather tends to be damp and sticky it is an advantage to broadcast, but if you are going to put the fertiliser along the rows the best methods is to spread the fertiliser first, cover it at least with an inch or two of soil, and then plant your cane setts above it. Another method is to wait until your cane shoots are up and then run a furrow along the side and put the fertiliser in that way. But of all the methods so far as we can see, applying the fertiliser in the same row as the cane setts but separated by an inch or two of soil, is quite a good method. Certainly it is reliable as regards cane.

There is another point that crops up, and that is, "When should you apply the fertiliser." If no bad results are to be experienced by applying the fertiliser when you are planting there is no doubt that with most of our fertilisers the crop has an advantage in being planted with the fertiliser. There is a possible exception in the case of nitrate of soda where top dressings during wet weather are probably best. With that exception I think it is important that plants should get a good start with fertiliser close at hand. With regard to the plots we have just come from you will have noticed that in the plots where Mr. Storey has had healthy and diseased cane planted that cane is behind all the other fertilised plots, the reason being that complete fertiliser was given to these about two months later than the others. I think the result is certainly noticeable.

While that cane is altogether better than the control plots with no fertiliser, it certainly is not so good as that where fertiliser was applied at the time of planting. In this case the fertiliser was put in and mixed with the soil and the setts placed in after the mixing, so that there was no intimate contact with the setts.

Mr. Kramer asked if Mr. Williams would explain what effect muriate of potash and sulphate of potash had on cane.

Mr. Williams replied that so far as the effect of both these were concerned, he did not think there had been any decisive experiments carried out in this country. Knowing that cane was one of a species which were lovers of salts in the soil, on that ground he thought muriate of potash probably would be the better form to use, but no definite experiments had been carried out in the country that he was aware of.

The following paper by Mr. C. J. Rapson, Chaka's Kraal, on "Streak Disease Control" was then read.

CONTROL OF STREAK DISEASE IN UBA CANE.

(Paper by C. J. RAPSON, Chaka's Kraal).

I honestly believe that we are at the junction of two ways; one leading to a continuation of a certain amount of prosperity in our industry, the other to the stagnation and ultimate ruin of our industry.

By ultimate ruin, I do not mean a sudden collapse of our industry; very favourable growing conditions may lull us into a false sense of prosperity, but if immediate and general steps are not taken to stamp out the disease, the time will most certainly arrive when, with unfavourable growing conditions, plus the effect of the ravages of the disease, a more acute state of depression than the period we have just passed through will eventuate and this will surely lead to the industry's ruin.

Let us assume, from a grower's point of view, a constant reduction of 10 per cent for his product or in other words, knowing your present income calculate on receiving 10 per cent less annually, and tell me if you would be content? Certainly, so far, no reliable figures are available as to the loss likely to be suffered by any planter with Streak disease in his cane, but as a planter I state definitely that cane with Streak disease suffered very heavily in comparison with healthy cane during the droughty period of the last two years.

As a disease Streak can be a most puzzling study; I have heard planters state that in a field they have come across Streak diseased stools flourishing as well as healthy cane stools near by; this is so, and I can well believe that where there is an abundance of plant foods that such cases will occur; the question arises though, "how many of our cane fields have an abundance of plant food?" Speaking generally the fields are lacking in plant food and therefore, speaking generally the state of healthy and infected cane showing no appreciable difference does not exist.

Again, the difference between plant cane infected and plant cane healthy under favourable growing conditions does not show a marked difference and it will be stated again as it has been stated in the past, that there is no advantage to be gained by selections of clean canes. Plant cane crop though if only one of say three or four croppings and diseased ratoons do show a marked difference to healthy ratoon. Let us as an industry take heed and work with a fixed object of eliminating the disease whilst it is a feasible proposition; a little neglect now, and it may be an impossibility in the near future. How often have

Streak Disease Control.—Contd.

we, in South Africa, seen an industry brought to the verge of ruin through the ravages of some disease or insect, which although of minor importance in its early stages, becomes ultimately powerful and destructive through lack of early control? We claim to have in the sugar industry a farmer of intellect, let us show that intellect to-day and combine in our efforts to stamp out this disease. No planter must be content with only a one, two or five per cent infection; clean cane and only clean cane must be every planters' objective. You may fail for a few years, but success will ultimately crown your efforts.

What are we to gain, if we eliminate Mosaic disease from the cane belt and have another disease, similar, perhaps not so detrimental, but nevertheless bad enough, still with us, and one that other canes are liable to contract. To-day our eggs are all in one basket, insomuch that we depend entirely upon one cane to make or break us. Are we going to allow that basket to be upset? I have spoken in this strain as I wish the planters to realise what delay in action to-day will ultimately mean to them as individuals.

I hope, the paper I am giving will not leave one with the impression that I am an egoist but, as I am to give my personal experience the use of the personal pronoun becomes imperitive in many cases.

My farm was one, that, when the disease was first made known to us in 1923 had an average infection of 10 per cent over all fields; the younger fields be more infected than old fields.

In 1924 it was my intention to plant 90 acres, and when, in October 1923 Mr. Storey broadcasted the information of Streak disease I had planted a matter of 50 acres. On examination of this 50 acres I was astounded to find that it was very heavily infected and decided therefore to clean up the 50 acres, rather than continue planting the balance of land (then prepared) with cane of questionable cleanliness. This proved a bigger proposition than I at first anticipated, and after having rogued this over thoroughly two or three times I was ultimately reduced to try clearing, absolutely, a matter of eight acres, part of the 50 acres planted.

Rogueing was consistently carried on until April 1924, and on that date no canes whatever were showing Streak disease. In December 1924 the field was again rogued and six stools in the block of eight acres showed Streak disease. From this field canes have been planted this year in three or four districts and up to to-day have not reproduced Streak disease. Some of you may remember that during last year's sugar week I asked Mr. Storey, "Could he explain why it was that the disease at a certain stage always travelled from one end of the sett to the other." This particular feature of the disease interested me greatly, and as far as possible I have endeavoured to follow the clue.

During 1924 I planted 80 odd acres of cane and by adopting the methods of selection that I will give you shortly I have so reduced the quantity of disease that it is now only the work of one man constantly to watch for a chance sett here and there over the whole area.

I will give three stages of Streak disease which I propose to illustrate by actual plants suffering from the disease.

Illustration (1) is a complete sett of Streak disease wherein the whole sett is infected. Any canes planted from such a stool will immediately reproduce Streak diseased cane.

Illustration (2) is what appears to be partly infected and partly diseased; you will notice it is a butt section and the disease is travelling from the lower portion of the butt and will, in time, infect the whole sett. This is what I will term latent disease. When planted, such a sett will throw up healthy looking leaves which will remain clean for any period of from six weeks to six months of growing. This stage, in my opinion, is the greatest source of spreading the disease, as with moderate or even careful selection and by planting whole sticks of cane, this will almost invariably be reproduced. This stage can be distinguished from the first or third stages by the fact that clean and infected sticks are growing on the one sett and principally by the growth of young shoots coming up wholly infected.

Stage (3) is the new infection caused by outside agents, and this will generally be found to be isolated sticks in an otherwise healthy stool, with healthy bull shoots.

The control of Streak disease is as much dependent upon good husbandry as upon clean selection. It is of little use spending much time, labour, and consequently capital, upon selecting clean cane for plants if these are to be deposited in the soil contiguous to old ratoon roots reproducing Streak disease. Your lands must be thoroughly prepared and if possible allowed to lie fallow for 12 months before being reploughed and planted; or in preference to allowing fields to lie fallow I advocate planting a rotation crop or legume. Green manures are cheap fertiliser and in addition tend considerably to stamp out any old roots from diseased stools of previous crop.

Clean plant cane of all weeds when young; this not only greatly assists your setts to establish quickly but enables you the more quickly to detect Streak disease. It is extremely difficult to detect Streak disease in an anaemic looking leaf, and cane that is smothered in weeds soon becomes anaemic.

METHOD OF SELECTION

The safest way to select plant cane is to gather all clean tops or by planting out 12 months old cane free from infection. It might well be argued that to select tops only for planting, would be an im-

Streak Disease Control.—Contd.

practicable proposition, and I would therefore advocate for the average planter that he select tops to plant say five to 10 acres. In 12 months he would have a useful stand from which to plant the ensuing year, which should supply sufficient first class cane for 30 to 60 acres of plant.

When planting whole sticks of cane, place the stick in the drill before cutting into pieces; this is advisable as it localizes any infected sticks inadvertently planted. Should any leaf of a stick planted show signs of Streak disease shortly after being planted the whole original stick must be removed and this can easily be done if the canes are cut in the drills. Too much care cannot be spent at this stage, as portions of cane are liable to remain dormant in the ground for many weeks and even months.

If the above method of selecting plants is followed it will be found that little or no cane will reproduce Streak disease, but as a safeguard against blank patches in fields I have found it useful to plant beds consisting of clean tops round about the fields. These are then transplanted to fill up any blanks caused by removal of Streak infected sets.

Need for Patience.

Do not be downhearted if, after many rogueings, and when your canes are say three to four feet high, you find, as it were, a heavy new infection has taken place; this is probably the last of your latent diseased sets come to light. Take them out, if not out of your whole seasons plantings then out of sufficient to enable you to have clean plant for next year. You have possibly done everything but score. Do it thoroughly once again now and even at the risk of having blanks in your fields, and you will be well repaid.

I know how disheartening it is to take out a fine healthy stool of cane, but by taking one out now you are probably saving many others in its immediate locality from infection.

Assuming that my theory of latent disease is admitted, the question naturally arises as to how do the sticks become infected at all. The answer, so far, must be purely theoretical. Assume for a moment that a clean sett of cane has been planted in say October of this year, and after the cane has grown to say three or four feet it becomes infected by the insect carrier . In all probability only one stick in a cluster will be so infected. During the growing period the infection will remain in the one stick only, but during the winter months or the non-growing period the infection will not only travel down the infected stick but enter the butts of all canes of that particular group. But as these latter are not making new leaves they do not show that they are actually infected. Should any of these latter sticks be planted in the spring of the ensuing year they will, undoubtedly, reproduce Streak disease in the course of time and they are what I term "latent" setts. There are many factors determining the stage at which the disease will become apparent; good or bad growing conditions, amount of infection in the butt of stick, length into which plant setts have been cut when planting, and the bud which has germinated.

An Actual Experience.

Now to illustrate this point I will give you actual figures of a 5 acre block planted with selected cane from a 5 per cent. infection field.

In this instance selected canes were picked by myself and every leaf examined for signs of streak disease, and no stick bearing leaves even doubtful were planted. On ½ an acre of the 5 acres tops only were used, the balance of the sticks being planted in the 4½ acres.

The first three rogueings, which were at intervals of from three weeks to one month, averaged 15 setts of disease per rogueing and only on the 4½ acres were these found, no disease being discovered on the ½ acre of tops.

This field was planted on 15th October, 1924, and the final rogueing took place during the last week in February, and 33 setts were taken out. These again were only found on the 4½ acres of whole canes planted, and every one without exception were butt setts.

Let me here explain what I mean by rogueing. My first, second, and third rogueing consists of removing the whole original cane planted, whether it has been cut into two or more pieces and whether Streak disease is apparent in more than one germinated eye or only in one germinated eye; to ensure this the stick is reconstructed when dug out. My fourth and final rogueing consists in removing only the canes actually showing streak disease, and in this latter case consists only of butt ends of original plants. This last rogueing should be done just prior to winter.

To summarize:

The spread of the disease is by an insect carrier.

One stick infected by the insect carrier is multiplied by the number of sticks on that particular stool.

Sources of spread of disease: infected fields contiguous to clean plant fields; old ratoons containing disease from previous crop on fields newly planted with clean cane; mealies bearing Streak disease.

Spread of disease will be in proportion to amount of disease present, due regard being paid to season, whether wet or dry.

At the conclusion of his paper Mr. Rapson exhibited some young cane and demonstrated how the disease extended from one section of the sett to others.

The Chairman then thanked Mr. Rapson for his interesting paper.

Mr. H. H. Storey, Government mycologist then read the following paper entitled "The Year's Progress in Cane Disease Investigations."

THE YEAR'S PROGRESS IN CANE DISEASE INVESTIGATIONS.

(Paper by H. H. STOREY, B.A., Government Mycologist, Durban.)

At each of the last Annual Sugar Conferences it was my task to draw your attention to a separate new and important cane disease. I am glad to be able to report this year that I have nothing new to add to the list. Nevertheless there is still a vast amount to be learnt concerning Mosaic and Streak diseases, and the year has been fully occupied in clearing up many points concerning them. The work with Mosaic has dealt mainly with the resistance of varieties and other detailed matters, and no great interest attaches to them at present. The main investigation however, has been directed towards the determination of the nature and manner of spread of streak disease.

A paper describing in detail the work which has been done upon Streak disease is now in the printer's hands, and copies will be issued to all members as soon as ready. A short summary of the conclusions reached may be of interest at present.

In the first place, it is definitely concluded that this is one of the so-called "virus diseases," a clearly marked group in plant pathology. This may at first sight appear to be a point of academic interest only; but when one has decided, on some of its properties, that a disease belongs to a certain group, one can predict other properties which are not readily subjected to test. This allows one to suggest the most hopeful measures of control, and to prosecute investigations in the directions most likely to lead to useful results.

In all the work which I have carried out, I have encountered no case where a plant once fully diseased has thrown off the disease and developed healthily. Spraying or sett disinfection have never been known to cure a virus disease, and are unlikely to affect Streak. Since the organism causing the disease is within all the tissues of the plant, it is inconceivable that the external application of chemicals could affect it. That point is so clear and obvious, that I consider that to attempt to test it would be to waste energy which might more profitably be employed upon other work.

Following suggestions made to me, I carried out experiments in digging up cane stools, which had recently developed the disease, and replanting them in the Herbarium grounds. Of a dozen such cases, all the originally diseased canes have remained diseased and the disease has spread rapidly to other shoots previously healthy.

The possibility of transmission of Streak through the soil was tested by the following experiment. On a site adjacent to the Umbogintwini Streak plots healthy cane was planted and certain setts covered with wire gauze cages, so that the shoots developed entirely within the cages. The gauze varied in size from one extreme with holes one-eighth of an inch square to the other with holes one hundredth of an inch square. After three months all the uncaged plants had become diseased; one plant in a cage of the largest mesh was diseased, all the remaining caged plants were healthy. This experiment showed that the disease was transmitted through the air by some agency, which was unable to pass through wire-gauze of sufficient fineness.

The streak disease affecting maize is well known probably to most farmers upon the Natal Coast. In many respects this plant appeared to be a more suitable object for study than cane; it was thought that if the mode of transmission of the maize disease could be worked out, the investigation of that of the cane disease would probably be simplified. The work upon maize Streak culminated during the past year in the discovery of an insect carrier, a leaf-hopper previously unknown and undescribed, Balclutha mbila, Naude. Much has been learnt concerning the details of the process of disease transmission by this insect, but these points are not of general interest at the present. It may merely be said that hoppers reared on healthy maize are unable to produce the disease, but that a proportion of those hoppers which have fed on a Streak plant, even for so short a period as an hour, became capable of transmitting the disease to every maize plant upon which they subsequently feed.

Transmission experiments with cane proved to be a matter of much greater difficulty. The hoppers which were proved to be able to infect maize failed to produce the disease in cane. Hoppers fed under experimental conditions on diseased cane failed to infect cane. This evidence appeared therefore to suggest that Balclutha mbila was not the carrier of the cane disease. The trial of all other likely insects failed to give any infection with streak.

In the experimental plots at Umbogintwini when Streak was spreading with great rapidity, Balclutha mbila was very abundant. Individuals collected here were found experimentally to infect both cane and maize.

There is little doubt therefore that Balclutha mbila is the actual carrier of Streak in the Natal canefields. But it is only under certain conditions that the hoppers can become infective. What are those conditions is clearly a very important subject for research, and I hope that during the coming year this point will be determined.

At this stage it is uncertain whether under any

The Year's Progress in Cane Disease Investigations.—Contd.

circumstances Streak can be transferred from maize to cane. But maize is held to favour the spread of Streak when grown in proximity to cane, since it appears to be a highly favourable food-plant for Balclutha mbila, and is likely to encourage the multiplication of the carrier of Streak.

This work forms a good example of the devious paths by which results may be obtained in scientific research. The study of maize has led to the solution of a sugar-cane problem. Without the previous work upon maize it is unlikely that the relationship of Balclutha mbila to Streak in cane would have been discovered. I therefore make no apology to the Sugar Association for a paper devoted largely to maize.

In thanking Mr. Storey for his paper the Chairman stated he felt sure the work which had been done would be most beneficial to the Industry in the future.

QUESTIONS ON STREAK DISEASE.

The next business which was proceeded with was the answering of various questions contained in the official question and answer programme issued to each member.

By special request Mr. Rapson was asked to give a specific reply to the question: "How may Streak disease be certainly diagnosed by the planter?"

Mr. Rapson replied:—The answer to that primarily is by the leaf. Streak disease is apparent in every leaf that has Streak disease in the cane. It has an elongated stripe right along the leaf and the whole of the leaf is so marked. You can finally determine Streak disease from any other leaf marks if you take out the heart leaf from a sett. By examining that you will find that if the sett is clean right through that heart leaf will be clean. But if it is a diseased sett it will also be diseased to the minutest portion of the heart leaf.

Mr. Storey gave the following reply to the same question, namely:—By examining the youngest, partly unfolded leaf of the shoot. If this bears, evenly distributed over its whole length, narrow colourless Streaks, then the plant has Streak disease. If there are no markings on this leaf, then the plant is healthy. If an odd marking or two only is to be seen, the plant is almost certainly healthy, although in a rare instance it might be a case of a new infection just starting. The Streaks are best seen by holding the leaf up to the light.

The Uba leaf is apt to bear many colourless spots upon its older leaves. These are not Streak disease unless the youngest leaves are also affected.

Question No. 7.—"What method is recommended for the selection of cane in the control of Streak?"

Mr. Storey replied: Selection should be done in a field as low as possible in Streak disease, preferably under 10 per cent diseased. The method of selection must be chosen so as to ensure the rejection of all canes the leaves of which are Streaked, and of all canes from a stool which shows any Streaked shoots. Whatever method be employed, it must be such that the selection is carried out before the leaves have been removed or allowed to wilt. It is suggested that specially trained boys be sent through the fields to cut out the cane of all stools which are wholly or partly diseased, or to mark these stools in some way such as by tying up or cutting the tops off. The remainder of the field may then be cut for planting. The diseased canes, if of suitable age, may then be sent to the mill. Alternatively, the boys may be sent through the fields to cut out healthy canes, or top setts from healthy canes. In such cases the boys should be required to bring these canes out on to the headlands complete with their leaves. which should be cut off only after inspection by an overseer.

Question No. 8.—"Why do Streak diseased plants appear in the young cane, even if selection has been carefully carried out?"

Reply by Mr. Storey: The diseased plants in this case are due to:—

(a) An error in selection, diseased canes having been allowed to be planted.

(b) So-called "latent infections." It is likely that some apparently entirely healthy canes had in fact contracted Streak disease a short time before they were cut, but too recently for any symptoms to have shown. Setts cut from these canes would produce Streaked shoots.

(c) Secondary infection from neighbouring diseased canes. If the insect-carrier is present, this is liable to happen, particularly on the edges of the field near to old diseased cane. If there are old roots from the previous crop still shooting, these are likely to act as sources of infection. Great care should be taken to eradicate them.

Question No. 9.—"When should roguing be carried out in Streak control?"

Reply by Mr. Storey: Roguing should begin as soon as the majority of setts have sent up shoots above ground. It should not be postponed. All diseased plants should be removed and the gaps filled. The next roguings should be at fortnightly intervals. It is likely that no diseased plants will be found at the third or fourth roguing. If many diseased plants are found after the fourth roguing, it is probably inadvisable to carry on roguing fur-

Questions on Streak Disease.—Contd.

ther. We want more information to be able to decide this definitely, and planters' experience will be valuable.

Question No. 10.—"Is any method known of curing a Streak diseased plant?"

Reply by Mr. Storey: No method whatever is known to me. I consider it to be unlikely that any practicable method will be found. As far as I know at present, preventive measures are the only ones likely to give success.

Question No. 11.—"Are there any varieties of cane which are immune to Streak disease? If so what is being done to make them available for the planter?"

Mr. Storey replied: It is impossible definitely to answer this question in the present state of our knowledge, but a number of varieties appear to be at least resistant to Streak, and some are possibly immune. Most important amongst these are the Argentine canes, which are Java seedlings imported some years ago (P.O.J. 36 & 213) also several of the recently imported Queensland canes which are to be seen at Mount Edgecombe. All of these varieties are susceptible to mosaic, and their use against streak is dependent upon the previous eradication of mosaic.

At the conclusion of the period which is contemplated for the eradication of mosaic it is expected that there will be small healthy stocks of these and other likely varieties available for issue for trial in different localities. Those will have been propagated in the quarantine greenhouse soon to be erected, and also probably in specially inspected and treated plots in the Experiment Station. The difficulty of course will be to retain those free from mosaic disease. If that cane can be made to survive the period of eradication or mosaic they should be available for issue as soon as that has been definitely determined.

Question No. 12: "Does interplanting of cane with mealies encourage the spread of Streak?"

Mr. Storey in reply said:—

Mealies are believed to favour the spread of streak although this point has not been definitely proved. It is not known whether Balclutha mbila can transfer streak from diseased maize to cane, but maize is a highly favourable food plant for Balclutha and is likely to encourage the multiplication of the insect, which will certainly lead to the spread of streak. The rapid spread of the disease in the "Hill Plots" at Umbogintwini is believed by me to be due to the fact that the plots were surrounded by maize at the end of last season. It is therefore not certain that maize encourages the spread of streak, but the risk that it might happen is great enough to justify the advice not to interplant maize with cane.

Mr. Munks asked Mr. Storey his opinion of the cane at the Hill Plots as against that at the Flats as to whether liming was the cause of the difference in the streak. The streak in the top lots was not so bad as in the other.

Mr. Storey replied that it was not fair or sound to judge from a single observation such as they had just seen. They could only tell by comparative experiments on the same plots, some limed and some not limed.

Mr. Blewett added that usually lime was added to soil which was sour. The plots on the flats were much more sour than the plots on the hill. So that so far as that point was concerned they were in far more need of liming down below than on the top.

Mr. Munks also asked if lime did not keep insects away, to which Mr. Blewett replied that agricultural lime had not that effect at all.

Mr. Patrick asked under what circumstances one would prefer mineral phosphates to the ordinary superphosphates.

Mr. Blewitt replied: I don't know that sufficient work has yet been done to answer that point very definitely, but I can answer one or two points in connection with that. In the first place if you had a soil which contains any appreciable quantity of limestone or a sweet soil, in such a soil the best phosphatic fertiliser is superphosphate. As to the soil in which mineral phosphates is to be preferred I say that on many of our sour soils mineral phosphates is very encouraging, especially if you have a good deal of organic manure present.

Where a man is using kraal manure the use of mineral phosphates is also sound. There is no doubt that rock phosphate is hopeless in a soil where there is plenty of lime, or you have had a heavy dressing of lime; it would be unwise to recommend mineral phosphates in such a case, but for a large number of soils there is no doubt a mixture of superphosphate and rock phosphate will give reliable and excellent results. The cheapest and best form of phosphate is probably the most important fertiliser problem of the day.

Questions on Streak Disease.—Contd.

When we started some two or three years ago to investigate the results of using mineral phosphates, to get the best results we found it should be ground to a very fine flour and air separated. When we tried the effect of mineral phosphates against other phosphates we got better results than we anticipated. Since then we have been carrying on the experiments.

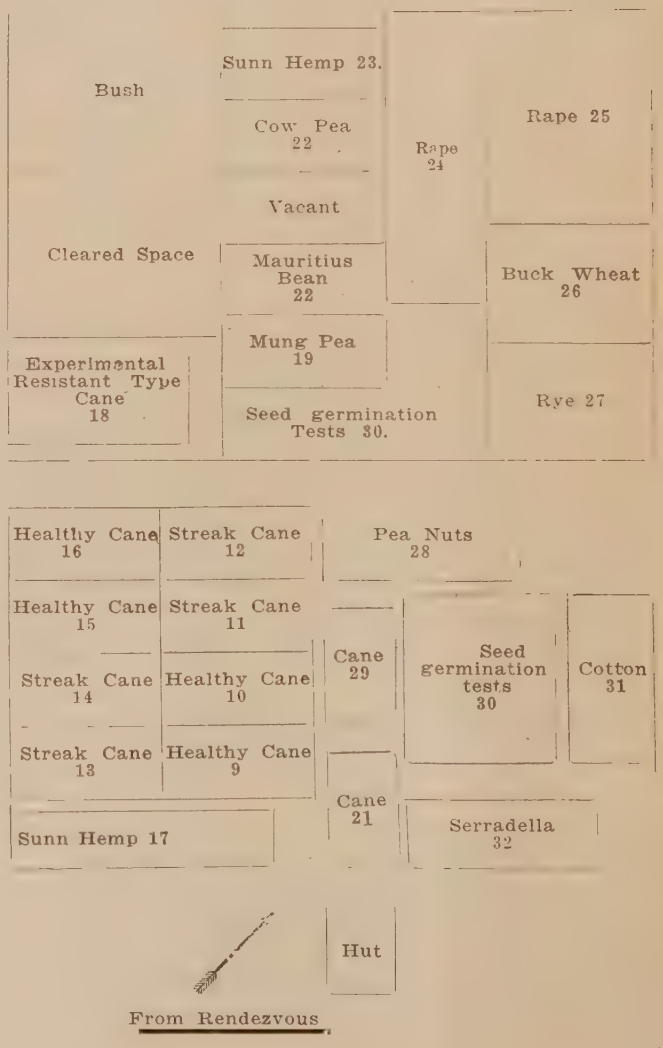
Mr. Dodds is very interested in this and has carried out a number of experiments with the various forms of phosphates, and I think we can agree on these points that with certain soils in Natal, not so much the sandy soils but more particularly the midland Natal soils which are sour owing to mineral sourness, the use of superphosphates is disappointing, and a less soluble form of phosphates such as a mixture of rock and superphosphate or bonemeal or basic slag is better for that type of soil. When you come to a sweet limestone soil superphosphates is far and away the best form to use. Between those two extremes it may be difficult today to lay down a hard and fast rule, but so far as I can judge a mixture of the mineral and superphosphates is the cheaper way of improving your soil.

AT THE UMBOGINTWINI EXPERIMENTAL PLOTS.

As soon as the weather effected a temporary improvement the party left for the experimental plots and spent some time examining the crops. From a sugar planter's point of view the plots demonstrating Streak disease were intensely interesting. On the one hand there was a plot of cane planted with the disease, and alongside of it another planted with Streak free cane. At four months old this latter cane contracted the disease from the former, by contagion, and one of the plots was so full of the disease as to be apparent to the most inexperienced person. But apart altogether from the obvious effects of the Streak on the leaves, a percentage of the cane growing in the plots planted with Streak free cane clearly showed a much greater improvement in the growth of the stalks than the neighbouring one. So close together were these planted that it was possible to touch the cane on either hand and compare the growth of the stools one with the other. All manner of theories have been put forward in the past tending to minimise the seriousness of this disease which has evidently been in the country for many years, but the ocular demonstration provided by Mr. Storey was beyond question. Seen at a distance all the plots looked very fine, the cane being uniform and of a beautiful rich greenness. For this the wet season is largely responsible, and it would be interesting to see the results in a droughty season. One naturally assumes that the results would be even more striking:

Besides the cane experiments various other plots of interest to Sugar planters were provided as will be seen from the following diagram:—

Station I. **DIAGRAM OF EXPERIMENTAL PLOTS**



At the Umbogintwini Experimental Plots.—Contd.

DESCRIPTION OF PLOTS. Section 1.

Nos: 9, 10, 15 and 16.—Originally healthy cane but now wholly streaked.

Nos: 11, 12, 13 and 14.—Streaked Cane.

These plots were planted in March 1924, using 1,000 lbs. of No. 6 Cane Fertiliser per acre on Nos. 10, 12, 13 and 15. All the plots were fertilised during 1923 with 500 lbs. of mixed fertiliser per acre.

No. 17.—**Sunn Hemp**—Planted 6th November, 1924, using 1,000 lbs. Rock Phosphate per acre.

No. 18.—**Experimental Resistant Type Cane—**

The plant cane (healthy) used for these experiments was taken from badly Streak and infected fields. The object being to prove whether or not these plants are resistant to the disease.

No. 19, Mung Peas
„ 20, Mauritius Beans
„ 22, Cow Peas
„ 23, Sunn Hemp.
— Planted 4th December, 1924, using 1,000 lbs. of Rock Phosphate per acre.

No. 24, and 25 Rape — Planted 27th February, 1925, after a crop of potatoes.

No. 26 Buck Wheat.
„ 27, Rye
— Planted 27th February, 1925, after a crop of potatoes.

No. 28, Pea Nuts — Planted 13th November, 1924, using 300 lbs. Mixed fertiliser per acre.

No. 29 Cane—Potash Fertiliser experiment.

No. 30, Seed Germination Tests.

No. 31, Cotton—Meade Long Staple. Planted 5th November, 1924.

No. 32, Serradella—Planted 6th November, 1924 with 1,000 lbs. Rock Phosphate.

No. 21, Cane—For dusting experiments.

Cane Plots in the Valley.

Owing to the state of the weather and the fields it was not possible to visit the river plots, but in the afternoon a visit was paid to the cane plots in the valley which were most interesting. Unfortunately a light rain made overcoats a necessity, and it was impossible to investigate very carefully the explanations which were broadcasted concerning these plots. Both Mr. Storey and Mr. Blewett gave explanations in regard to the plots and the experiments upon them.

The following diagram will illustrate the experiments as set out in the fields:—

STATION 3.

CANE PLOTS IN VALLEY.

33.	6 rows	Control.
34	6 rows	600 lbs. No. 6 Cane Fert. per acre.
	35.	Streak Cane.
	36.	Healthy Cane.
	37.	Streak Cane.
	38.	Healthy Cane.
39.	4 rows	600 lbs. No. 6 Cane Fert. per acre. Rock replaced by Superphosphate.
40.	4 rows	Control.
41.	4 rows	600 lbs. No. 6 Cane Fert. per acre Land treated with 600 gallons Molasses per acre.
42.	4 rows	600 lbs. No. 6 Cane Fert. per acre containing no Potash.
43.	4 rows	Control.
44.	4 rows	600 lbs. No. 6 Cane Fert. per acre. containing no Nitrogen.
45.	4 rows	600 lbs. No. 6 Cane Fert. per acre. Soil treated with 500 lbs. Silicate of Soda per acre.
46.	4 rows	Control.
47.	4 rows	600 lbs. No. 6 Cane fertiliser per acre, using Superphosphate contg. Magnesium Phosphate.
48.	4 rows	600 lbs. No. 6 Cane fertiliser per acre. Land treated with 5 galls. Microl per acre (Soil Steriliser).

All plots received 1,000 lbs. agricultural lime per acre with the exception of the Plots 35, 36, 37, 38. All the above Plots were planted with Mr. C. J. Rapson's cane 22/11/24 and fertilised when planting, as shown.

Plots 35, 36, 37, 38, were planted with Esperanza cane 27/11/24 after a preliminary dressing of Rock Phosphate and a complete fertiliser was applied 22/1/25.

HEARTY VOTES OF THANKS.

Mr. O. J. Johnson (Chairman) then asked the members to pass a vote of thanks to the staff of Kynochs who had so ably assisted in making this such a splendid day in spite of the weather; also to the ladies for the tea and refreshments (hear, hear) and to Mr. Blewett, Mr. Williams, Mr. Storey and Mr. Rapson for the excellent manner in which they had given the information required.

Mr. D. L. Patrick stated that on behalf of all the planters it gave him great pleasure in saying how pleased they had been with their reception at Kynochs and the arrangements which had been made for the day. There had been no limit to the generosity of their hosts, not only on account of their hospitality, but for the way they had entered into the experimental work of Mr. Storey and Mr. Dodds. He thought that they, as a Sugar Association, had taken the credit for a good many of the experiments which had really been ensured by the

At the Umbogintwini Experimental Plots.—Contd.

work of Kynochs. They fully appreciated all that had been done to help them in their problems connected with cane.

Mr. Blewett expressed his thanks for the complimentary remarks of the various speakers, and his pleasure that the Sugar Association had honoured them by spending the first day of their "Sugar Congress" at Umbogintwini.

A hearty vote of thanks to the Chairman (Mr. Johnson) then concluded the proceedings of the day, and the members returned to Durban by special train.

Second Day's Proceedings.

Thursday, March 26th, 1925.

Chairman of the day: Mr. D. L. Patrick.

For the second day at Mt. Edgecombe the conditions were more propitious. It had rained heavily the greater part of the night, and the fields and roads were very wet and muddy, but the weather remained fine all day. Unfortunately the programme had to be modified, the trip to Umblanga Rocks having to be abandoned, as well as visits to the more distant parts of the Estate.

On arrival the guests were taken to the factory, where seating accommodation was provided in the newly erected commodious sugar store. After brief preliminaries Mr. Wm. Campbell delivered his paper on the carbonatation process which was especially interesting to everybody. Mr. Campbell had shorn it of all the technicalities so that it could be followed by the layman in sugar manufacture

Tea and other refreshments were then served in the same building, after which the guests were taken on a tour of inspection of the factory and were then conveyed in motor cars to the Experimental plots, and afterwards to the Irrigation System, about a mile from the homestead.

WHY WE ADOPTED THE CARBONATATION PROCESS.

(Paper by W. A. CAMPBELL, Managing Director, Natal Estates, Ltd.)

I wish to take you back, ladies and gentlemen, to the early days when this factory was built by Mr. Alfred Dumat, a most eminent French Engineer, and the father of the present Doctor Dumat.

Alfred Dumat introduced a system of clarification, which though wasteful in steam, was to my mind, the simplest method for securing an even grade of white sugar in a Defecation mill, and strangely enough on my writing Home a few years ago for expert advice on the trouble we had in making white sugar by defecation, Doctor Schalk-Sommer advocated the method which Mr. Dumat had introduced, with open clarifiers, bac Portals and Taylor filters. This system was altered in 1909/10, when the factory was remodelled.

Mauritius is the Home of the making of defecation white sugar by sulphur, and this process was invented by Doctor Icery as far back as 1868.

Do what we could, and armed with the very best advice to be obtained from England, Mauritius and

Why We Adopted the Carbonatation Process.—Contd.

Java, our losses in the treatment of juice compared most unfavourably with the rest of the sugar countries of the world, and furthermore we found that in a large factory it was almost impossible to produce an uniform white sugar, which is so essential in the manufacture of sugar for domestic purposes.

This unsatisfactory state of affairs led us to seek other avenues of information, and it occurred to me that our Uba juice, because of its viscosity, was somewhat analogous to the beet juice. I thereupon wrote to Doctor Schalk-Sommer, and asked his advice about starting a carbonatation factory here, and his reply was such that we immediately decided to adopt the carbonatation process.

Our next difficulty was to find someone in the country who had a knowledge of carbonatation and limestone, and we opened up correspondence with Pretoria without result. Whilst we were considering the matter of sending Home to get someone suitable out here, Mr. Wuthrich, Consulting Sugar Chemist, and Mr. Mitchell, late of the Sugar Machinery Manufacturing Company of London, arrived on the scene.

Mr. Mitchell gave us his practical knowledge on how to start and equip the factory with the machinery we had at our disposal, and Mr. Wuthrich contributed his technical knowledge.

We are indebted to both these gentlemen.

I need hardly mention, as it is common knowledge to you all, the troubles we had in the introduction of this process. In the first place the lime kiln fire bricks which were supplied in the Union, fused, and ran out in a molten liquid; and secondly we were faced with the problem of the extraordinary viscosity of the Uba juice, which confounded the technical experts.

Credit is entirely due to the staff in overcoming these difficulties, and in this connection I would like to mention the names of Mr. Simpson our Chief Engineer, and Mr. Rault our Chief Chemist.

The patent tower which you see in the factory, and which utilizes the so-called exhaust gas, was one of the chief factors in overcoming our initial troubles.

I am dividing my Paper into the four following heads:—

(1) The reason for name, and basic principles of the process.
(2) Kiln work.
(3) Juice treatment.
(4) Results obtained and advantages.

I must say that but for the whole-hearted support of Mr. Harold Payne, who was then the Chairman of the Company, the introduction of the carbonatation process at Mount Edgecombe, would have been very seriously delayed.

Name, and Basic Principles of the Process.

In cane juice clarification, Lime is almost the universal clarifying agent, but for a thorough purification, a large excess must be used, and this excess has to be removed by a neutraliser.

Carbonic acid gas has been found to be the cheapest neutraliser of excessive quantities of lime, and the most economical way of making use of lime and carbonic acid gas is by burning limestone (lime carbonate) in a lime kiln where 100lbs. of limestone produces 56lbs. of quick lime and 44lbs. of carbonic acid gas.

As its name implies the Carbonatation process is essentially connected with the production and use of carbonic acid for juice treatment.

By burning the limestone in a lime-kiln, we separate it into its two constituent parts, that is, quick lime and carbonic acid gas. In the carbonatation of juice, we reserve the destructive work of the kiln, and combine again the carbonic acid gas to the lime in the presence of juice.

It is this formation of new soft powdered limestone in a dirty cane juice which constitutes the basic principle of the process. In doing this we charge a large excess of pure lime into carbonate of lime, and the French chemists have named the process "carbonatation," and this name has clung to it, although more correctly it ought to be "carbonation."

Kiln Work.

The kiln here is the standard Belgian type and burns 40 to 50 tons of limestone a day in a continuous operation. When lit, a few days previous to starting the mill, the fire is kept alive right through the crushing season.

It is fed with limestone broken to the size of a man's fist, and coke in the proportion of 9 per cent. coke to the weight of limestone. The coke is added to promote heat and also to produce an excess of CO_2 (carbonatation) gas.

A lift raises the stone and coke in wagon loads to the top of the kiln, and at regular intervals charges of the mixture are dropped in by special arrangement.

At regular intervals also the burnt lime is drawn away at the bottom of the kiln, so that the limestone and coke mixture is practically in a continuous slow descending motion in the kiln, whilst it is getting burnt to quick lime and ashes.

The heat of the kiln is maintained by the burning of coke, and also by the strong draught of a powerful gas pump, which regulates the burning of the kiln, and at the same time sucks the gas and delivers it to the juice side of the sugar house.

The presence of a pump intensifying the heat of a kiln and controlling its output of gas creates new conditions which do not exist in the usual lime kiln where the burning of lime is the only aim.

Why We Adopted the Carbonatation Process.—Contd.

In our case burning of lime and gas production are of equal importance, and has to synchronise with the juice production of the factory; on that account a carbonatation lime kiln demands technical ability, and a vigilant scientific control.

The burnt quick lime is slaked and diluted to a cream in a rotary drum, which is sieved to get rid of unburnt particles, or dirt, and after cooling is ready for the juice treatment.

The carbonic acid gas sucked from the top of the kiln is cooled and scrubbed before reaching the gas pump

The lime kiln, lime slaking and lime storage is in a separate building from the rest of the factory, and together with the gas pump constitutes a department of vital importance to a Carbonatation Mill, as any defect there would eventually cause crushing operations to stop.

A well balanced kiln work, which means perfectly burnt lime, and a plentiful supply of gas, is conducive to a safe, easy running on the juice side to such an extent, that sugar-men experienced in the suphitation process with the vagaries of that craft called "juice tempering," no longer care for this old process, and quite paradoxically, and contrary to the outsider's general opinion, called the CO process the simplest in existence.

Juice Treatment.

The first step in juice treatment is heating raw juice from the mills to a temperature of about 140 deg. F. This temperature fulfils the best conditions for gassing, filtration and colour of juice.

The hot juice is sent to the gassing tanks where "carbonatation" is conducted.

Our practice is to fully open the valve connecting the gas pump to the carbonation tank, so that all the gas from the kiln is being blown into the juice, whilst a continuous stream of lime cream runs in the juice, mixes with it, and is carbonated.

The lime cream flow is regulated so that nearly all the lime is neutralised and only a small percentage left as free lime. This is checked by means of specially prepared test paper which turns pink or white according to the amount of lime neutralised.

The reason for continually neutralising the lime instead of letting the full quantity act on the juice, and then neutralising (as is done in beet root practice), is that with the new method the violent frothing common to juice full of free lime, is considerably diminished.

This frothing is particularly noticeable with Uba cane juice, and in our first trials we found that, as already mentioned, the viscosity of the Uba juice was such that for the first portion of gassing the juice would not absorb the gas, and because of this we pump the raw juice from the mill to the patent tower 30 feet high.

This juice meets the exhaust gas from the tanks and gives it a pre-gassing. It also acts as a save-all and foam breaker.

The addition of lime in the juice with its simultaneous carbonatation is continued until the operator judges that the juice is sufficiently treated for a quick filtration.

A sample of muddy juice taken from the tanks would then show in a test tube a quickly settling mud, with a clear yellow juice on top. The real test, however, is the spread of filtration when the juice is sent to the filter press.

An experienced carbonator adds a uniform quantity of lime in each tankful, and the safest method is to add a slight excess of lime in case juice from bad cane should have been treated. The average quantity of lime used for Uba juice is about 12 per cent. by volume at 15 deg. Beaume.

Other countries would naturally think this excessive, but we find by practice that it is the safest figure we can use; although I have known juices for short periods take only 8 per cent. of cream.

The action of lime on hot juice is to neutralise the natural acidity of the juice, kill the germs, and coagulate and bind various impurities inimical to sugar extraction, and this action is further helped by the formation of carbonate of lime in the juice. Added in large excesses to the viscous Uba juice, it really changes for the better the physical qualities of the refractory juice, especially by acting on the gummy substances which in other processes slime the presses, retard the boiling, and diminish the extraction of crystals.

The juice treated with the proper quantity of almost neutralised lime can now be easily filtered in filter presses, where the mud is kept as a solid cake. The lime cake contains nearly all the carbonate of lime (limestone) from the kiln together with the impurities removed from the juice, and constitutes a very valuable fertilizer.

For every ton of sugar produced, one ton of this fertilizer is sent to the fields.

Due to its porous nature this cake is easily washed free of the sugar it contains, so that in spite of the heavier quantity of cake manufactured in the CO_2 process, the sugar losses in scum cake are smaller than those of any sulphitation mill. The cake is washed until it contains but ½ per cent of sugar by weight of the cake. The defecation process gave us 8 to 11 per cent. by weight.

The clear filtered juice containing a small amount of free lime in solution is sent to a second series of carbonatation tanks where the final neutralisation is carried out.

Carbonatation, carried out in two stages that is, double carbonatation, is safer than the single process, as it allows of rectification of mistakes at the first stage.

Why We Adopted the Carbonatation Process.—Contd.

Whereas the 1st, Carbonatation takes an average of 10 minutes, the 2nd one is carried out in about 1 minute, but demands a finer adjustment, as it is the final gassing.

The 2nd CO_2 juice after neutralisation is heated to 165 deg. F. and sent to another series of filter presses where the small residue of lime carbonate in suspension is removed.

The clear filtered neutral juice is then slightly sulphured to a quantity equivalent to a tenth of that used in sulphitation mills, when juice becomes slightly bleached, a favourable condition for white sugar. It is then heated to boiling point and filtered again.

From there it is concentrated and another filtration given, after which it is boiled to grain.

Results obtained and advantages.

1. All juice from the Mills reach the Evaporator in 30 minutes. Probably 4 or 5 hours were required with the former process.
2. The Mills have an uninterrupted run.
3. Due to pure juice obtained, the capacity of our boiling house and centrifugal department has increased at least 30 per cent.
4. An increased recovery of sugar. Better quality of sugar.

Comparative Figures of Sulphitation and Carbonatation Mills in White Sugar Manufacture.

1. Rise in purity from raw juice to syrup: Sulphitation, .5 to 1.5. Carbonatation, 4 to 6.

2. Gallons of molasses per ton of Cane: Sulphitation, 6 to 7. Carbonatation, 4 to 5.

3. Sugar lost in molasses per cent of the sugar in the juice: 13 per cent. to 14 per cent. sulphitation; 8 per cent. to 11 per cent. carbonatation.

4. Weight of scum cake per cent cane, 3.5 to 4 sulphitation; 10 carbonatation.

5. Loss of sugar in cake per cent sugar in the juice, 3.5 per cent sulphitation; 0.5 per cent carbonatation.

6. Recovery of pure sugar in bags, per cent of the sugar in the juice, 73 per cent. to 77 per cent. sulphitation; 83 per cent to 84 per cent. carbonatation.

AN EXPLANATION.

At the conclusion of his address Mr. Campbell stated that guides were present to conduct members through the factory. He was sorry to say that owing to the heavy rains they had experienced it was impossible to get anywhere near the main green manuring fields but they would be able to see one of the smaller fields near the factory. The plot he had intended to show them however, was one giving about nine or ten tons of Mauritius beans to the acre, and he regretted very much that it could not be reached.

The Chairman in thanking Mr. Campbell for his address stated that they were under a very great debt to him. It may seem a very easy thing to some people to read a paper in simple language so that non-technical people could understand it, but he could assure them that it was a most difficult thing to handle a technical subject in a non-technical way. Mr. Campbell had explained to them how much had been spent to get an extra 7 to 10 per cent. improvement. It was those 7 and 10, and even 5 per cent. improvements which were going to put them in a position in the future to be able to compete with the whole world (hear, hear).

They could also see that it was not only one section of the industry that had its problems to deal with—the millers as well as the planters had their problems to deal with, and it was only by understanding each other's problems that they were going to get down to real work and co-operation together (hear, hear). The millers had just as many problems as the planters, if not more. They were also dependent to a certain extent on the planters problems and the manner in which the planters solved them. Later on he hoped to refer to the way in which Natal Estates Limited had helped the planters to solve their problems.

He then asked the members to join him in a hearty vote of thanks to Mr. Campbell, which was enthusiastically accorded.

Mr. Campbell expressed his appreciation of the remarks made and the reception accorded him.

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THE QUEENSLAND CANES.

Owing to the excessive rains of the previous few days, and particularly the heavy downfall of the previous night some of the field demonstrations had to be abandoned. At the Experiment plots, there are being grown in a quarantine area the canes introduced from Australia by Natal Estates, Ltd., about two years ago.

The chief object of these plots is to endeavour to discover a substitute for Uba, but great care has to be taken to prevent the introduction of Mosaic disease, to which the majority of these canes are subject.

These canes were examined with great interest by the majority of the planters present, but it seemed to be the general impression that they would have been more valuable from a planters point of view had they been some months older. Their qualities will certainly be more pronounced when they are more mature.

Mr. Storey, the Government mycologist through the loud speaker, explained the special points of the canes, which very briefly are as follows:—

Badila, a deep rooting purple cane, giving a very high sucrose content when mature. This cane which originated in New Guinea, has a very high reputation in Queensland.

The 1900 Seedling, a cane produced in Mauritius, which has a sucrose content nearly as good as Badila, and which, under suitable climatic conditions may give 40 tons to the acre;

D1135, a hardy cane, frost-resisting, which has the reputation that Uba has for ratooning well. Its sucrose content is believed to be higher on the average than Uba. This cane is of Demerara origin.

HQ694, has the reputation of being a great drought resister, and also has a high sucrose content. It is a seedling of Queensland origin.

Clark's Seedling, also produced in Queensland, is a good soft cane, but cannot stand dry weather conditions, and is therefore suitable for irrigated lands. It has a low fibre content and high sucrose content.

Gingor, a comparatively new variety, reported to have a very high sucrose content.

Q813, a self-trashing cane, and a favourite with farmers who have good lands. It takes some little time to establish.

M189, originally came from Mauritius, and is a hardy cane with a high sucrose content.

Mr. Storey referred to several of the varieties as being likely to be very suitable for irrigated land in Natal and Zululand and for the areas on the flats. He stated that the cane was infected to a considerable extent with Mosaic but showed no sign of Streak. Mr. Storey emphasised that the future of this cane was contingent upon the eradication of Mosaic disease. Mr. Storey spoke of the wonderful possibilities of these canes, but also pointed to the comparatively small loss likely to be borne in carrying out the preventive measures which he has advocated for the eradication of Mosaic disease.

Mr. Storey went on to say that the cane being inspected was proved to have a high resistance against Streak disease, although it could not be said at that early stage that it was entirely resistant.

AT THE IRRIGATED FIELDS.

Leaving the experimental plots the party went for a long trudge up to what is known as Mount Moriah, the distribution centre for the irrigation works. Water is pumped up to this point from the Sir Marshall dam, to a height of 370 feet. From here it flows down the slopes through a series of small furrows similar to the system of water-leading employed in the Cape Province.

Mr. C. A. Ritchie, Irrigation Officer of the Natal Circle, who was in attendance, explained the method of irrigation and answered a number of questions. He also explained the system adopted at Natal Estates by which the main feeder furrows run along the tops of the slopes with smaller irrigation furrows passing from these and irrigating between the rows of cane. He emphasised the necessity for keeping these streams as small as possible so as to reduce erosion and losses of fertilizer to a minimum. The ideal irrigation system, he said, was one under which the cane would be planted on the level contours and the water fed to the cane through pipes or conduits with openings at certain intervals, but that would be much more costly.

Owing to the extraordinarily muddy state of the road the party proceeded to return on foot and on the way down the hill wandered into the cane fields and inspected the furrows and also noted the difference between the cane under irrigation and that which was not irrigated.

On another part of the Estate there are 1,200 acres under a green manure crop where it was intended to give what would have been a most interesting demonstration of ploughing on the cable principle, but unfortunately, owing to the condition of the roads and fields, this portion of the programme had to be abandoned.

On arrival back at the experimental cane plots, the party rejoined the motor cars and were conveyed to Mr. W. A. Campbell's residence where luncheon was served.

THE LUNCHEON.

As Mr. Patrick observed at the luncheon, Natal Estates, Ltd., does all things well, and this was certainly exemplified in the lavish scale on which the luncheon was provided. Two large rooms were utilised, one opening into the other, and the tables extending along the centre of each were most attractively set out with an array of eatables such as would have done credit to the Whitehall Rooms or a Lord Mayor's banquet. The tables were beautifully decorated, and also contained a great variety of liquid refreshment ranging from van der hum to Johnny Walker, and from ordinary soda to the best wines.

The menu "card" was a unique feature, consisting as it did of a small bag of Natal Estates Ltd., carbonatation sugar, bearing on one side the well-known brand of the company, and on the other the menu, which was as follows:—

SOUVENIR MENU
LUNCHEON.
(Natal Estates, Ltd., Mt. Edgecombe, 26th March, 1925.)

Hors d'oeuvre Quadruple Effet
Fish (Scarified)
Sausage a la Massecuite
Ratoon (umpteenth) Chops
Mosaic Chicken Streak Turkey
Ngulube Cornubia
Centrifugal Jelly Scum Pie
Cane Borer Cheese
Salads: Green Natal, Uba.
Cafe Treacle Noir
Wines:
1st Carbonatation (Light Claret)

Third Sugar Week.—Contd.

2nd Carbonatation	(Vin Blanc)
Fermented Juice	(Beer)
Tshimiyana	(Whisky)
Dunder Water	(Aerated Waters)

The design and origination of the idea were due to Mrs. W. A. Campbell. There was one of these souvenirs for each of the guests who were immensely pleased with its novelty.

The dishes served under their peculiar names were somewhat camouflaged, "Scum Pie" for example being a delicious confection that proved most attractive to everybody judging by the number of urgent requests for a return of the dish. Needless to say the rest of the menu was of equally excellent quality.

After the guests had been given ample time for doing full justice to the luncheon, and after the usual loyal toast had been honoured, the chairman of the day Mr. D. L. Patrick who presided over the gathering introduced Mr. H. Wallace Soutter, Chairman of Natal Estates, Ltd., who addressed the assembled guests in a very earnest speech, which was received with applause and other marks of appreciation.

MR. SOUTTER'S SPEECH.

Mr. H. Wallace Soutter, Chairman of Natal Estates Ltd., who had motored out for the occasion, addressed the gathering by means of the broadcasting apparatus. He spoke of the great pleasure it afforded all connected with the Board of Management of Natal Estates, Limited, to have such a number present that day as their guests. Continuing he said: I am sure if it were possible—and perhaps it is possible, for those who preceded us,—our managing directors of days gone by, Sir Marshall Campbell and Mr. David Don—to be aware of our proceedings to-day, they would be very gratified in knowing that the traditions of hospitality and goodwill of the Natal Estates, Ltd., were being maintained (Hear, hear, and loud applause).

I did not know until I arrived here this morning that I should have an opportunity of speaking to you, but speaking as an outsider and looking to the whole of the Sugar Industry of Natal, there are one or two things which have impressed themselves upon my mind and which I venture with some reluctance to mention to-day. The Sugar Industry of Natal and of South Africa is to us of prime importance, but in comparison with the world's output, of course, ours is infinitesimal. The estimate of the world's output for the coming season is 22 million tons of sugar. Of this Cuba is expected to produce four and a half million tons and with these providential rains the output of Natal may be estimated at 200,000 tons (hear, hear). Now, without taking a depressed view, the time may come when Natal with its limited output will have to face the competition of the world, that is to say the sugar world, and that means that there must be a total change in the outlook of all of those who are engaged in the Industry to-day.

I venture to say that there is a total lack both of co-operation and co-ordination as between the planter and the miller and the miller and the distributor (applause). We find to-day that there are differences (sometimes grave differences) between the planters and the millers, which I am not going to dilate upon, but I venture to say that there are also differences between planters themselves and I ask you whether it is not worthy of consideration as to whether there is that brotherliness amongst planters themselves which ought to exist. That is to say, do you not think perhaps there is a tendency towards a little selfishness. If certain things are found to apply with advantage to certain fields, is a planter always ready and anxious to give his fellow planters, with similar fields, the benefit of his experience? I think there should be close co-ordination between planters themselves, but that is not sufficient. I think the time has arrived, if we are to compete in the world's markets, when amongst the millers themselves there must be a much closer co-operation. There is no reason why that should not be. An important matter both to planters and millers is the disposal of the crop, and in view of the possible competition of the world's market, it seems to me almost criminal that we, with our small output, should not be able to arrange a fair measure of control so that the most might be made of our small output, the same as is done with the sugar crops of other countries.

I venture to say that planters and millers and distributors should come together in much closer union and discuss in a friendly way their difficulties and their problems and their prospects, and by that method only shall we derive the utmost benefit from the Sugar Industry of South Africa (applause).

There is just another point I would like to refer to, and that is this: That having been in Johannesburg for many years, and intimately connected with the mining industry, it has been impressed upon my mind that working costs, and always working costs, are the important consideration, because upon working costs depend the prosperity or otherwise of the mining industry. Now when we come to the Sugar Industry, which is a growing industry (and it will become very much more important as the years go by) I ask whether planters are considering their working costs; whether they are satisfied that every care is taken so that they know themselves what the cost of producing cane is. If they analyse their expenses they will find means of improving in their working, and perhaps methods of economy which will make all the difference to them.

Your Chairman at the meeting this morning spoke of the importance small savings, such as five per cent

and seven and a half per cent, make in schemes of economy, and I cordially agree with him because we must not only consider the five per cents, but even the quarter and half per cents when considering methods of economy. Millers should bear this in mind, and there should be as close an analysis as possible in an endeavour to discover methods by which losses may be saved. When this is secured, and there is co-operation and goodwill amongst all those who are engaged in this great Industry of ours then come what may, we shall be able to hold our own, we shall be able to compete in the world's market in an increasing degree (loud applause).

Now gentlemen, it remains for me to assure you again of the great gratification it has been to us to extend to you our hospitality, to show you over our factory and our fields, because I want you to believe that there is no improvement of any importance made on Natal Estates which is not readily open to all who would like to take advantage of it (loud applause).

MR. PATRICK'S RESPONSE.

Mr. Patrick in rising to propose a toast said he was very sorry that the Chairman had taken a lot of the wind out of his sails. It was not the first time Natal Estates had taken the wind out of the sails of many people, but it was the first time they had taken the wind out of the sails of a planter.

He desired the gathering to drink to the health of Natal Estates, Ltd., coupled with the name of the Chairman Mr. H. Wallace Soutter.

Being a parson's son, Mr. Patrick said he would like to use a biblical quotation in referring to Natal Estates, Ltd., which was: "He (they) doeth all things well," for that expressed Natal Estates' traditions in every way. People had heard it said that there were more brains to the square inch on the Rand than anywhere else, but he found that applied to a definite part of Natal. In this connection he drew the attention of the guests to the original and unique type of menu (small bags of N.C. No. 1 Refined Sugar) which was originated and carried out by Mrs. William Campbell. It was absolutely unique. Incidentally he remarked that this sugar would keep for three years, so far as its physical keeping qualities were concerned, but not its family keeping qualities. Natal Estates produced the finest mill sugar in the world. They were at the top of the tree in more ways than one, particularly in their technical work. As an example he said they tried two or three American and English machines for weighing the juice, but had never been able to get any successful results from those they had tried, until they got their own men to work, and turned out a juice weighing machine which was invaluable. This was remarkable considering that English and American brains had been first tried, not to mention other countries. This juice weigher was accomplished principally through the efforts of Mr. Simpson, the Engineer on the Estates.

Mr. Patrick went on to explain that Natal Estates were at the top of the tree as millers, because in the first place they have a very sensible and human side towards their planters. He with others had the privilege of talking to one of the planters who was about to make an agreement with Natal Estates, and they chaffed him. In reply the planter said, "Gentlemen, I could not have asked for anything better myself" (laughter). That would show that from a miller's point of view, and from the planter's point of view also, Natal Estates were at the top of the tree.

The opinion he quoted was that of an individual planter, but if they came to consider the position from the point of view of the Industry, he would like to mention that they were recently looking around for a site for an experiment farm. There were engaged upon it all the expert brains from Cedara and other places, and being in a quandary Natal Estates came to their assistance, offering a suitable site, and he would like to tell them that the terms upon which that was granted were terms that could not possibly have been beaten. It was a most striking example of an endeavour to help the planting side of the Industry. He desired to express on behalf of the planters, if not for the South African Sugar Association, their very sincere appreciation of the way in which Natal Estates had come forward to help them out of their difficulty over the experiment station. It had enabled them to make a start.

Turning from the sublime—to something else, he mentioned that it was a favourite jibe of the Englishmen and the Irishmen, when they wanted to show their superiority over the Scotsmen, to point out that they were civilised when the latter were only climbing trees. As a matter of fact they argued that not only were the Scotchmen climbing trees, but they had got fairly high up in the trees and had stuck there ever since. They might ask what this had to do with Natal Estates. He believed that if they were to look at the list of Directors they would find half of them were Scotchmen and the rest foreigners, as the Scotchman called them, because they came from South of the Tweed, but in any case it was what one might call a fifty-fifty directorate (laughter).

He would just like to refer to one thing their host had touched upon and that was costs. Planters' costs were awful. He did not mean to say on account of their magnitude, but because of the different methods of keeping them. There was no uniformity or anything which would enable them to make out a really good case for consideration. He believed each one could tell what his neighbours were doing, and what his millers were doing, but did

not know how to sort out his own costs, and find out exactly what he was doing. What they wanted were uniform methods and uniformity of ideas.

He would like to put forward a suggestion in regard to another department of the Industry, and that was the technical staff. It seemed to him that a lot of the papers read at the Sugar Congress were very technical, although perhaps not enough for some of the staff. It seemed to him that there should be a technical body of some kind composed of all technical men, such as engineers, factory men, chemists, and others of that kind, who would be able to discuss the various problems freely without giving away any trade secrets, and they could help their own people, as well as circulating certain information amongst themselves and others, and give each an opportunity of criticising the work done and besides reducing the costs help to build up a more uniform method right through.

He called upon those present to charge their glasses and drink to the health of Natal Estates, Ltd., coupled with the name of their Chairman, Mr. H. Wallace Soutter.

The toast was received with musical honours.

MR. CAMPBELL'S SPEECH.

Mr. William Campbell, Managing Director of Natal Estates, Ltd., who responded to the toast, said he was a very poor deputy for their Chairman, Mr. Soutter. He had hoped that the latter gentleman would reply to the toast, and give them one of his witty speeches. However, he would like to say on behalf of the staff, that they very much appreciated the presence of the members of the Congress of the South African Sugar Association. Mr. Patrick, being an Irishman, had rather drawn the long bow, but he had to acknowledge that by the adoption of the carbonatation process they had increased the quantity of their sugar. He would like to say that they did not claim to manufacture the Char process quality of sugar, but what they did claim was to turn out from the cane a percentage and quality of sugar that Sir J. L. Hulett & Sons in combination with their mills and refinery, were not able to do. This also was a matter which was exercising the attention of the English refiners. The competition that the refineries were receiving at Home was due to this same process, developed in recent years, which enabled a factory to produce a domestic sugar direct from the beet without sending it to a refinery. He did not wish to enter into a controversy, but he did say that it would have been impossible for Natal Estates, Ltd., to have increased the price to its planters had it not been for the carbonatation process which they had introduced (hear, hear) and he did wish to add that they had increased their price to their planters by something over 30 per cent and were still making the same profits out of them which they did in former years when working the sulphitation process (very loud applause).

They must also realise that Natal Estates, Ltd., as a milling concern were favourably situated so far as marketing their sugars were concerned. When they took into account the mills in Zululand, they would find that in rail carriage alone on their sugars there was £1 a ton of difference which made an enormous difference in the price which a miller could pay to his planters, and also in the matter of making dividends.

He hoped that planters, in comparing Natal Estates' prices with those paid by other millers to their planters, would realise the disadvantages millers, say, in Zululand, were under and he might particularly mention the Umfolozi Co-operative Millers' Association who have to pay railage on their sugars to Durban, and also exorbitant rates for machinery and other goods sent from Durban to their factory. He could assure them it made all the difference in the world.

He also wished to express the appreciation of the Chairman and his Co-Directors for the excellent manner in which Mr. and Mrs. Patterson had catered for the gathering that day (applause). They were assisted by the employees of the Co-operative Society, which, unfortunately, according to law they had to form into a limited liability company. The Directors had encouraged the staff as far as possible in starting this co-operative society which had undertaken to repay the money advanced within four years.

Mr. Campbell concluded by again expressing the pleasure he and his Co-Directors felt at having such a large gathering present on that memorable occasion.

CONGRESS RESUMED.

After luncheon the tables were cleared and the party reassembled for the Congress. A very busy afternoon was spent listening to the various papers and discussing points arising therefrom.

The afternoon's proceedings were commenced with a very interesting address by Mr. C. Edelman, Agricultural Experimentalist at Cedara, who dealt with a number of interesting agricultural problems. In the course of the afternoon Mr. H. H. Dodds, Director of the South African Sugar Association Experiment Station, delivered a paper on "Green Manuring," and Mr. T. A. Warner gave a very interesting talk on "Approximate Methods of Farm Surveying" in which he gave a lot of useful practical advice on laying off land and measuring plots followed by a discussion. A long paper on "Animal Transport on Sugar Estates" was read by Mr. V. C. Schwikkard, Field Overseer, South African Sugar Association Experiment Station.

About 5 o'clock, just before the Congress finished its labours for the day, the health of Mr. & Mrs. W. A. Campbell was drunk with musical honours with hearty expressions of enthusiasm, and thanks.

THE PRACTICE AND PRINCIPLES OF GREEN MANURING.

(Paper by C. EDELMAN, Agricultural Experimentalist, Cedara.)

Mr. C. Edelman, Agricultural Experimentalist, Cedara Agricultural College, then addressed the members as follows:

With regard to papers on green manuring, it has been suggested that I should give the fundamental principles of green manuring while Mr. Dodds goes into the matter more deeply. Therefore I don't think I will keep you very long. Green manuring as we know is one of the means of conveying humus or organic matter to the soil. We know humus to be the decayed vegetable or animal matter. To put it very plainly we may say this: that green manuring is really a substitute for kraal manuring. We know from experience that kraal manure proves beneficial on practically every kind of soil, but we also, unfortunately, know that the supply does not nearly equal the demand. That being the case we have to find another crop or another manure to serve the same purpose as kraal manure, and we try to find that in what is known as green manuring. In other words we try to grow a crop in the soil to plough it in to replace the organic matter which is annually lost from the soil.

If we only study the soil for a moment, if we only study its composition, we find that it contains humus, mineral matter, living organisms, and water. In order that we can get the best out of the soil we have those four things present. As soon as one is absent it is like a chain with a missing link; there is absolutely no connection. Of course we are rather viewing things this year under what may be termed magnified spyglasses. With so much rain every sugar cane crop looks to be thriving and you can hardly tell the bad from the good.

The purpose of my paper is to try and drive home the importance of a good organic matter supply to the soil when the conditions are totally against growing crops. Now if we only study the functions of humus then do we really realise what it performs in the soil. I read this out to you at your last Congress and I wish to read it out to you again. It is entitled "The Sad Thing about Organic Matter or Humus."

I don't mean that humus is all that is necessary for the soil—far from it. But in order even to get the best out of artificial fertilisers it is necessary to have a good humus supply. If we consider the functions we know that humus is the main source of nitrogen in the soil and as soon as the nitrogen is deficient you cannot expect to get a healthy growth of sugar cane or other crops. Nitrogen is responsible for the vegetative part of the plant, so that a soil deficient in nitrogen means a soil that cannot grow anything but a very very weak crop. We know this also, that several soils do not require nitrogen, but we don't know that several soils do not require humus. It is on account of this kraal manure, or green manure or humus that food is supplied for the micro-organisms, and if the food is there the organisms do the rest; they convert it into nitrogen and once in that form the plant can take it over very readily indeed. We also know that humus or organic matter improves a light sandy soil by making that more retentive for moisture and most probably for fertiliser. With regard to heavy clay soils we know it tends to make that more loose or friable.

An experiment was conducted with organic matter in a clay soil as follows: a certain portion of clay soil had extracted from it its organic matter content and then the soil was allowed to freeze and thaw again. Once the organic matter was out of the soil, in spite of the fact that it was allowed to freeze and thaw, it remained one hard mass, but as soon as the humus was replaced that same soil was again allowed to freeze and thaw, and on thawing it broke down into a fine mass. So it will be seen that it can improve the extreme soil and also the other extreme, the light soil and the heavy clay. It has a binding effect in the case of a light soil and in the case of a clay soil it makes it more open.

We all know the majority of clay soils are too tight and if we can get some substance to make them open and easier for cultivation then we are working on the right lines. Not only that but we know that our richest soils are very often situated in the vleis, but they need drainage and other things. I really would be more happy lecturing to a lot of maize farmers because I have done more work with maize. At the same time it is very gratifying to note, as you all heard yesterday, that it is thanks to the maize that Mr. Storey has been able to find out so much about the Streak disease in sugar cane (hear, hear). So perhaps I shall feel more at home with you to-day.

As I pointed out at the commencement I am just giving you the fundamental principles, and the fundamental principles are the same for all crops. What I want to make clear is this: that soils no doubt need artificial fertilisers and not fillers; you all know that by now (laughter). I am a great believer in fertilisers provided you use the right ones. But there comes a time when your organic matter becomes exhausted. Take for example the medium types of soil, medium to heavy. There comes a time when that organic matter becomes exhausted and

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work as you will you can never get a fine tilth. I can see the roller followed by the disc harrow followed by the ordinary harrow, and followed again by the roller, disc and harrow, only to bury the lumps and bring them up again. If you fail in that respect I think that the soil really needs organic matter or humus. Of course we know that green manuring supplies a certain amount of plant food other than nitrogen, but really that is taken as of little account. The particular thing about a soil is its physical condition and once you lose the humus you have lost the physical condition

I overheard a conversation on the question of whether green manuring paid or not. I believe they have about 1,200 acres of green manuring at Natal Estates. If you want to know if green manuring pays I think you had better ask Mr. Campbell. You see how very important it is to maintain the organic matter in the soil. You know that when your land is ploughed up the first time you expect good crops for a year or two. Why is that? Because it is rich in humus. But as time goes on that humus is burnt out we might say, and your soil becomes poor. Well the idea is not to let that humus get burnt out or wasted but to maintain it year in and year out. You will see therefore that from every point of view you cannot go wrong by using humus for the land. There may come a day when someone will be able to supply it to farmers in the same way as artificial fertilisers are supplied to-day.

Now what is the first step towards soil improvement to-day? If we consider the fairly heavy clays we know that they most probably need drainage. If we consider most of the sugar lands we know they are somewhat on the light side. The first step towards improvement is the addition of humus. If you have some other ways of applying humus to the soil we don't say go in for green manuring. We know that unless mixed farming is practised and stock are kept, and you have not a good supply of kraal manure and cannot buy it very readily, you are apt to sell your fertility of the land or give it away. In future when you sell sugar cane or mealies ask them to pay you also for the fertiliser that you sell; don't give it away for nothing as has been done in the past.

Study the moisture content of the different soils or the holding capacity of the different soils for moisture. We find that with the sandy soil 100 lbs. of sand will hold about 25 lbs. of water, a heavy clay between 50 and 75 lbs. and when we come to the humus or vegetable soil we find it holds double its own weight of water. Think what has happened in the past. Of course, as I have said, this year we are seeing everything at its best. But it is in a dry year that we want to see these things and not in a year such as this. We know perfectly well, as Mr. Blewett told us yesterday, that in a dry season the fertiliser will have an effect on the seed and so on. We want to find something that can be used in a dry year that does not prove detrimental either to the soil or the welfare of the crop.

We cannot have too much of humus in the soil say for sugar cane. There are cases where you can overdo the humus business and have too much, but I don't think you will ever get to that stage in the near future or as long as we live. Again if you consider your alluvial soils, your soils which don't need fertilising; you can probably get 15 bags of mealies to the acre without fertiliser. To what is that richness due? Largely to this organic matter or humus. The humus is the peacemaker of the soil. Without that the bacteria and even the water and all the other plant foods are at loggerheads with each other and can't get on until "Mr. Humus" comes stepping in to such an extent that it is buried with the soil. We know then from every possible point of view that humus proves beneficial for the land. As far as I can make out you have undoubtedly got a green manure crop for the summer months. We have got very fine crops of Mauritius Bean—a species of the Velvet Bean—and other green manure crops, and we also saw yesterday a very tall growing crop known as Sunn Hemp. Of course we know that Sunn Hemp should be ploughed in when it was half that height or even less.

Seeing a green manuring crop growing to about six or eight feet reminds me of one of the shows held in Scotland. At a Show there were some very large beetroot. There was one huge beetroot weighing about 30 to 40 lbs. The judge came along and put a first prize ticket on that. The old Scot came along and said "It may be very good, but where are you going to get a pot to put it in?" Well it is the same with that green manure crop when it gets about 6 feet high, I don't see where you are going to get a plough to plough it in. We know there are two types of green manuring crops, the legumes and the non-legumes. These will be dealt with better by Mr. Dodds I think.

There is one thing I would like to say. If you intend practising winter green manuring I think it will be necessary to grow the seed first in the area to acclimatise the seed. We know that winter crops do best in the cooler climates. For instance one of the worst green manuring crops we saw yesterday was that of Rape. That does not thrive in a climate such as this unless it is planted towards the end of March and the soil has plenty of moisture. In our experience we found a crop of that sort does better with medium to heavy soils and not on sandy soils. I also saw rye which was not looking too good. If you have to bring on a winter green manuring crop the first step in that direction is the growing of the seed first because unless you get acclimatised seed on your farm you never can rely on good results.

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You will se therefore that we have these different types of crop. We have the long growing crop and the crop that matures in a very short while, but I still think we might improve on getting a suitable winter crop provided we can get suitable seed.

There is another paragraph I would like to read out to you in regard to the nitrogen supply of the soil. We know at present it does not affect South African conditions in general but this is an extract from an American Bulletin:—

"Except on those soils which still have a large proportion of unexhausted nitrogen left, the nitrogen problem is a most important soil fertility problem before the farmer. . . . Legumes and green manures are needed in larger degrees . . ."

You will see we are ever facing problems and trying to solve these different problems. I have tried to show you briefly the importance of organic matter or green manuring in the soil. In conclusion I would like to add this: As a means of restoring the humus content of the soil, as a means of lessening soil erosion, and as a means of getting the best value out of the artificial fertilisers, green manuring may help you to gain the goal. In other words, I would like to say that the success of any farming depends on no factor more than the maintenance of the soil fertility and without humus you can never maintain the soil fertility. (Loud applause).

The Chairman on behalf of the members expressed their appreciation of Mr. Edelman's address.

GREEN MANURING FOR SUGAR CANE.

(Paper by H. H. DODDS, Director of Experiment Station, Natal.)

It is evident that the main agricultural problem in nearly all the older sugar growing countries is the progressive exhaustion of the organic matter, or so-called humus, in the soil, and many parts of Natal also appear to have reached this stage. Records of soil analyses and comparative yields of cane in the early days are lacking, but I believe that many old colonists will agree with me when I suggest that the soil in Natal, like the old grey mare in the song "ain't what it used to be, twenty long years ago." However that may be, there is no doubt that the records of soil analyses from different parts of the province show that in the older sugar growing districts and even in many of the new ones there is now a marked deficiency of organic matter in the soil.

Insufficient attention has been given to this essential factor in the past. On the more scientifically conducted estates commercial fertilizers have been systematically applied for years, together with sugar house waste products rich in the required lime, so that the soils in these cases are not usually conspicuously lacking in other plant food ingredients in an available form, but in nearly every case they are deficient in humus. On very few estates has any attention been paid to the cultivation of green manure crops as a source of humus, and that only within the last two or three years. This deficiency in organic matter is still more marked in other parts of the province where cultivation has been less intensive and where the practice of burning the trash from the cane has been systematically followed.

To restore and maintain the fertility of the soil I believe it will be necessary to institute the practice of green manuring as an essential part of our system of agriculture. Unfortunately it has not been to anyone's direct pecuniary benefit to any considerable extent, except to the planter himself, that green manure crops should be grown, hence the vigorous and effective propaganda which has been devoted to the sale of some other of his raw materials has hitherto been lacking in this instance.

In the sugar growing districts of Louisiana the exhaustion of the fertility of the soil after long continued heavy cropping reached an acute stage a few years ago. The yield of cane per acre has steadily fallen during the past few years from 18 tons per acre per annum in 1921 to 7 tons in 1924.

Several causes are contributory to this decline including mosaic disease, various insect pests and unfavourable seasons, but in the opinion of those who are in the best position to judge the principal cause is the decrease of permanent fertility. Some years ago second and third ratoon crops were commonly grown, now one ratoon crop is the most that will give satisfactory returns and even this usually shows a marked decline in yield compared with the plant cane.

The rotation which came into general use was two years of cane comprising plant and first ratoon crops, followed by a rotation crop of maize, the residues (stalks, etc.) of which were ploughed in as early as possible and succeeded by a green manure crop of cowpeas which was ploughed in before planting cane for the following season. This practice certainly postponed the day of reckoning for a time, but it soon became evident that the progress of soil exhaustion had only been checked and not stopped even though commercial fertilizers were extensively used.

Looked at from the point of view of the nitrogen balance which is a convenient rough method of estimating the fertility of the soil arithmetically,

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136 lbs. of nitrogen per acre were required for the growth of the two crops of cane and at most only 78 lbs. of nitrogen can be supplied by the cowpea crop, so that there is a net loss represented by 58 lbs. of nitrogen in the rotation, without taking into account the loss in nitrogen in the grain and cobs of the maize which may amount to 34 lbs. per acre with a 25 bushel yield. It was not considered practicable on most estates to devote another year to fallow with a second crop of cowpeas or other green manure.

The problem is analyzed very clearly in several of the annual reports of the Committee on Agricultural Progress of the American Sugar Cane League, especially in 1922 and 1923.

Eventually a method was discovered at the Louisiana Sugar Experiment Station of introducing another green manure crop into the rotation without extending the cycle and with very beneficial results.

The usual practice in Louisiana is to plant cane in October, when it remains dormant in the soil throughout the winter, and begins to grow in the following spring. Several winter growing clovers and other plants were tried and it was found that melilotus indicus, a melilot known as yellow sweet clover, was of the greatest value. It was planted on the cane in October and when ploughed in preparatory to cultivation of the cane in the spring it was found to add 10 to 13 tons of greenstuff per acre which contained nearly two tons of humus, and over 100 lbs. of nitrogen, equivalent to nearly 700 lbs. of sodium nitrate costing about £11 (without the humus).

The average sugar cane yield in the experiments was over 14 tons per acre compared with less than 10 tons from adjoining control plots, an increase in value of about £5 per acre directly due to the green manure at a cost of not more than 14/-.

Not only this, but the exhaustion of soil fertility had been checked and the balance restored.

Similar increases were found on plantations where the method was given further trial on a larger scale. The benefit to Louisiana is incalculable since it is not too much to say that this practice will save the industry in that State.

Further details will be found in Louisiana Bulletin No. 189 by W. G. Taggart, and in recent annual reports of the Louisiana Experiment Station. This instance has been described in some detail as a remarkable example of the benefits of green manuring for sugar cane. In other highly developed cane growing countries such as Mauritius, Queensland and others, green manuring has long been practised and even in those countries where less intensive methods are still practicable, as in Cuba, it is coming into use. In South Africa the need is likely soon to become urgent, the descent into the abyss of infertility is likely to be the more rapid here in view of the wasteful methods of cane cultivation, such as the practice of burning the trash, the erosion of surface soil which frequently occurs in heavy rains and the natural lack of phosphate and alkalinity in the soil.

The difficulty of devising a suitable scheme of applying green manures in this country is great in view of the prolonged ratooning periods, for which it is not easy to suggest practical methods of green manuring. Much, however, could be done with land which is due for replanting with cane, and a year's fallow could very profitably be employed in growing a succession of green manure crops appropriate to the different seasons of the year.

The discovery of the best crops to grow for this purpose is one of the most important tasks before the experiment station, and several trials in different localities have been begun this year.

Green manure crops may be classified into legumes and non-legumes. It has been observed since very early times that certain crops in many cases appeared to enrich the soil instead of impoverishing it, but the reasons for this fact have only been understood within recent years. One striking example of the benefits of green manuring was shown in 1880 when Schultz in East Prussia converted some barren sandy heath lands into fertile soils by growing lupins.

In Britain green manuring is not practised very extensively. In the systems of mixed farming in use there, usually in connection with a highly developed stock-raising industry, it is generally preferable to feed crops to stock and return the manure to the soil instead of turning the crop into the soil. But even there, according to Sir John Russell, of the Rothamsted Experiment Station, a greater use of green manuring would be advisable, and the quantity of humus returned to the soil should not be limited by the number of animals the farmer finds it convenient to keep.

The legumes are usually the more highly recommended for green manuring since they have the property of harbouring certain bacilli in their root system which can absorb nitrogen from the atmosphere and fix it in the plant so that it eventually enriches the soil. This factor is naturally of paramount importance where nitrogen is the dominant fertilizer requirement, which is the case in the cane sugar industry almost everywhere. In South Africa, however, there is evidence to show that conditions are rather unique in this respect, as in others.

Although the nitrogen content is seldom very high, it is not very low even after exhaustive cropping providing that there is sufficient organic matter present. In fact, it has been found, as Mr. Blewett will tell you, that the proportion of nitrogen in the organic matter of soils from similar areas remains remarkably constant even after much nitrogen has been withdrawn by a growing crop. Like the widow's cruse of oil, the small amount of nitrogen never seems to fail and I believe this is one

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reason why commercial mineral fertilizers supplying nitrogen only are usually found unprofitable when supplied alone, or even when mixed with a phosphatic fertilizer or in a general mixed fertilizer beyound relatively small quantities of the nitrogenous ingredient.

Besides the bacteria mentioned above, which can only flourish on the root nodules of leguminous plants, there are other bacteria in the soil (known as azotobacter) which also have the function of absorbing nitrogen directly from the air and do not live in plant roots. They require a sufficiency of organic matter in the soil and neutral conditions (neither strongly acid nor alkaline)—incidentally invert sugar is one of the best kinds of food for them, hence the special benefit of applying molasses and filter press cake to the soil. Although these bacteria cannot fix as much nitrogen as the root bacilli of the legumes, it would appear that soil conditions in this country are usually very favourable for their activity, if they are provided with sufficient organic matter. I am inclined to believe that in many of our soils if we take care of the humus, the nitrogen will take care of itself. Consequently non-leguminous green manure crops are likely to be very useful in this country even though they do not directly contribute nitrogen from the air. If so, this is very fortunate since many of them will flourish in lack of moisture and other unfavourable conditions such as most legume crops would not tolerate. Some of them also make more rapid growth than legumes.

Some brief notes on the plants which may possibly be grown for green manuring may now be given.

Velvet beans (genus Stizolobium formerly Mucuna). This is generally believed to be the best of all the commonly used legumes for green manuring but requires a well drained non-acid soil with sufficient available phosphate; it is sensitive to frost.

It is very free from disease or insect pests and is immune or very highly resistant to eelworm and wilt which are very liable to affect certain varieties of cowpea. About 20 varieties are known and many hybrids. Owing to its climbing habit it is frequently cultivated in combination with an upright crop for its support. In America maize is sometimes used for this purpose; sunflowers may also be used or in old cane lands a few cane stools may be left standing to support the beans.

The amount of seed used is about 50 lbs. per acre and the time taken to grow to the flowering stage, which is usually the best time to plough it in, is about four months under Natal conditions.

In the block which was to have been observed this morning a yield of 9.6 tons per acre was obtained which represents 1.32 tons of organic matter containing 73 lbs. of nitrogen, equivalent to the nitrogen in over 500 lbs. of sodium nitrate. This season has, however, of course, been unusually favourable hitherto for the growth of a green manure crop such as this.

Mauritius Bean or Black Bean (S.aterrimum) is another species of the same genus which is also a very useful green manure plant.

Cowpea (Vigna spp.)—This may be described as a general utility leguminous green manure crop, being grown for this purpose in sugar cultivation more than any other crop. While it is usually not quite so luxuriant as velvet beans it is more adaptable to a greater variety of soils, although it flourishes best in sandy soils or sandy loams and should be well provided with lime.

As in the case of most legumes it is best to fertilize with phosphatic and potassic fertilizers on poor soils.

Cowpeas are indigenous to Africa. There are 15 common and well defined varieties and many other strains of mixed origin or known only in certain localities. Certain varieties such as Brabham, Iron, and others are known to be resistant to wilt and eelworm (root knot) to which most of the varieties are susceptible. If the seeds are to be stored for any length of time, it is advisable to fumigate them with carbon disulphide or hydrocyanic acid to destroy weevils; they are very subject to the attacks of these insects. Under favourable conditions cowpeas will yield organic matter containing 60 to 80 lbs. of nitrogen per acre.

Mung Bean (Phaseolus aureus).—This is a plant of Indian origin which is an excellent green manure crop. It is of erect habit and consequently can be more easily ploughed in than either velvet beans or cowpeas. It gave a rapid and luxuriant growth at the Louisiana Sugar Experiment Station but was found very liable to be eaten off by caterpillars.

It has done very well in the co-operative experiments at Chaka's Kraal and Empangeni this season, but a small quantity recently tried at Umbogintwini was attacked by some root fungus.

Sunn Hemp (Crotolaria juncea).—This legume appears to have been comparatively little grown for green manuring, but obviously has great possibilities in this direction. It has made very tall and rapid growth in very poor sandy soil at Umbogintwini. It is a very fibrous plant and has been grown in India as a source of fibre. For use as a green manure probably it would be better to plough in after it has attained a height of about 3 ft. in order that decomposition may be sufficiently rapid. The seed which is difficult to obtain locally at the present time should be applied at the rate of about 40 lbs. per acre.

Yellow Sweet Clover (Melilotus indicus).—This plant which as mentioned did so remarkably well in Louisiana unfortunately has uniformly failed hitherto wherever it has been tried on the Natal Coast, in common I understand with other clovers. Apparently it only flourishes in localities having winter rains.

Green Manuring for Sugar Cane.—Contd.

Lupins (genus Lupinus)—As mentioned these have done very well on poor sandy soils elsewhere, but there has been no opportunity of obtaining sufficient seed locally for experiment up to the present.

All of the above legumes excepting the two last named have been found to form freely the root nodules which harbour the nitrogen fixing bacilli There are many proprietary cultures of these bacilli for various types of legumes on the market, for which wide claims are sometimes made. However, in the event of any ascertained deficiency of nitrogen nodules it is simple and effective to scatter a little soil (air-dried in the shade) from some field which has been growing a similar crop. A kind of swelling or gall on the root fibres caused by eelworm, (a nematode worm which affects certain legumes such as many varieties of cow pea) is liable to be mistaken for the nitrogenous root nodules. However the interior of these galls are white until they have destroyed the root when they decompose turning brown, whereas the interior of the nitrogen nodules is a more or less greenish tinge. Under a low power lens or magnifying glass the female eelworm may be distinguished in the former as a small pearly white, pear shaped body about the size of a pinhead. The best remedy is to use only immune varieties until the pest is starved out of infected fields.

Buckwheat (Fagopyrum Spp.)—This appears to be the best so far of the few non-legumes that have been tried in Natal as a green manure. It will grow on almost any soil that is not waterlogged and will do well on poor sandy soil deficient in moisture although it responds to good conditions. It has done well planted very early in the season during very scanty rainfall which leads one to hope that it may make some growth during the driest months. It grows rapidly so that it may be ploughed in, five or six weeks after sowing. The seed should be broadcasted at about 40 lbs. per acre. At present seed is plentiful and cheap locally.

Buckwheat appears to be little affected by diseases or insect pests. It is a good bee plant, as the flowers yield excellent honey.

Rape is another quick growing non-legume that has been recommended as a green manure crop. The preliminary trials with it have not been very successful, but were both on unfavourable soils; one a poor sandy soil at Umbogintwini, and another on a waterlogged clay at Empangeni. It is proposed to give it a further trial on a somewhat better sandy soil at Tinley Manor.

Mustard, oats, and rye are also non-legume crops which are worthy of trial under suitable conditions as green manures, but as far as I am aware have not yet been used for this purpose on the Natal Coast.

It is perhaps somewhat premature to indicate after so little experiment any system of green manuring but it would appear to be a promising course, after ploughing and harrowing the old ratoon stools, to sow broadcast a crop of buckwheat if the cane has been cut early in the season. This could be ploughed in after about six weeks or so and followed by a crop of velvet beans, cowpeas or other legume according to the kind of soil. By this time the weather would be sufficiently warm and moist to ensure rapid growth of the legume. After ploughing in the legume, possibly another crop of buckwheat could be obtained before the dry weather had set in. In this way three green manure crops could be obtained before it was time to replant with cane.

In case of late harvested cane the first crop of buckwheat would have to be omitted.

Lime and fertilizer should be applied as early as possible in the rotation, so that the benefit would be available to each crop in turn.

After a green manure crop has been ploughed in, no other crop should be planted for two or three weeks in order to give the green manure time to decompose in the soil.

The quantity of humus and nitrogen actually added to the soil by even a heavy green crop is small, compared with the total amount already present even in the poorest soils.

Thus, assuming the weight of an acre of land to a depth of 1 foot to be 1,500 tons, a very low organic content such as 1.5 per cent represents 22 tons per acre, whereas as we have seen a heavy green manure crop will only contribute 2 tons of dry organic matter per acre. Probably some of the actual benefit derived must be attributed to other effects of the green manure crops, possibly an increase in the number and activity of the bacterial flora of the soil.

Our hosts, Natal Estates, Ltd., are to be congratulated on being in the matter of green manuring as in other respects in the forefront of scientific progress in the sugar industry of this country.

I would like to take this opportunity to say how much I appreciated Mr. Soutter's remarks regarding the need for united effort in the sugar industry. Mr. Blewett suggested yesterday an excellent slogan of "30 tons of cane per acre." That is very good as far as it goes, but I do not think it goes far enough.

The end and aim of the sugar industry is not only to grow cane but to produce sugar, and I believe that our immediate aim even with our two year crop ought to be "two tons of sugar per acre per annum" and with united effort we can do it.

Green Manuring for Sugar Cane.—Contd.

At the conclusion of Mr. Dodds' paper the Chairman said:—

"We have had two lecturers who have shown us that we don't know how to grow cane, and I must admit there is a good deal at the bottom of it. I think the Natal men all these years have been on the right track with their trashing, otherwise they could not have expected to grow cane for fifty years on the same ground. Of course I know we don't all hold the same ideas in Zululand, but we are living on our capital I am afraid and we are going to pay for it bye and bye (hear, hear). There is no question about that. It is not a personal opinion, it is a fact. These gentlemen have shown you in how many ways you could find a green manuring crop to suit any condition of climate, time of the year and soil. We have not much time left to-day and as the majority of the questions you would ask are on the agenda for to-morrow you can ask all the questions you like to-morrow. I will just ask you to join me in a vote of thanks to Mr. Edelman and Mr. Dodds for the very interesting and enlightening papers they have given us (loud applause).

APPROXIMATE METHODS OF FARM SURVEYING.

(Address by T. A. WARNER, Government Land Surveyor.)

It seems a very far call from green manuring papers to one on such a different subject as surveying, but from remarks which were passed at lunch I think it was brought home to us how necessary it is to get a little more accurate data in connection with the work which we do, not only in our factories, but also on our farms, so that we can get comparative results and know from the financial point of view whether it pays us to do certain experiments which may appear to our scientific friends to be very nice. We want fairly accurate figures as to whether they really pay or not.

From the farmer's point of view the first problem he is faced with is the one of being able to accurately lay off his farm and know the area of his fields. This particularly applies to sugar, where you have comparatively speaking a crop of great value per acre, probably more so than most other crops, and so from the sugar planter's point of view this matter is rather important.

There is another aspect of the problem, and it is really one of the reasons that has tempted me to inflict you with this address to-day. In my professional experience I have unfortunately lately come across quite a number of cases of rather serious disputes between buyers and sellers of farms as to the acreage of the cane existing on their farms. At the present time I am interested in two cases which I am afraid will go to the Supreme Court and you know what that means. I am quite satisfied in my own mind that in none of these cases has there been any deliberate attempt on either side not to give accurate figures. The position has been that the people have not sufficient knowledge to really know what acreage they had. They thought they had it but they find they had not. I don't want you to think that I am going to give a talk on surveying so as to pass Government standards for purposes of transfer, but if I can show you a simple way by which an ordinary person of average intelligence can measure up his fields to within a reasonable amount I hope that will be of some value to you (hear, hear).

Fortunately on the coast of Natal our lands are not very highly mineralised particularly with regard to iron, and therefore we are able to make full use or could make full use of the prismatic compass. Many people bring me problems and ask me to give them the area of their fields, and they give a whole lot of measurements and ask me to tell them what the area is. Now that is a physical impossibility for anybody to do and I think where the average person goes wrong is that they put a great amount of stress on to the actual measurements, that is to say the lineal measurement, without taking any account of the angular measurements; the one is just as important as the other.

We should try to retain our unit of measurement and that is the link. In towns and places where a lot of building has to be done gradually the foot method of measurement has ousted the link, but people to-day are beginning to think a good deal more than they did with regard to link measurement; it is the one little bit of decent decimal unit that we have in the whole of the British standard of Weights and Measures. It is very simple and easy and I cannot understand why it is not used more than it is.

There are 100 links in a chain, the equivalent of which is 66 feet. The advantage is that there are 100,000 square links in an acre. If you are measuring up a field and you can reduce it to a parallelogram it is quite simple. In links 500 by 200 equals 1 acre; 600 by 400 equals 2.4 acres, etc. I will give you a few examples (demonstrates on blackboard). There is only one figure of which you can get an accurate area by linear measurement and that is from the triangle. On level ground as in the Orange Free State and Transvaal fields are gen-

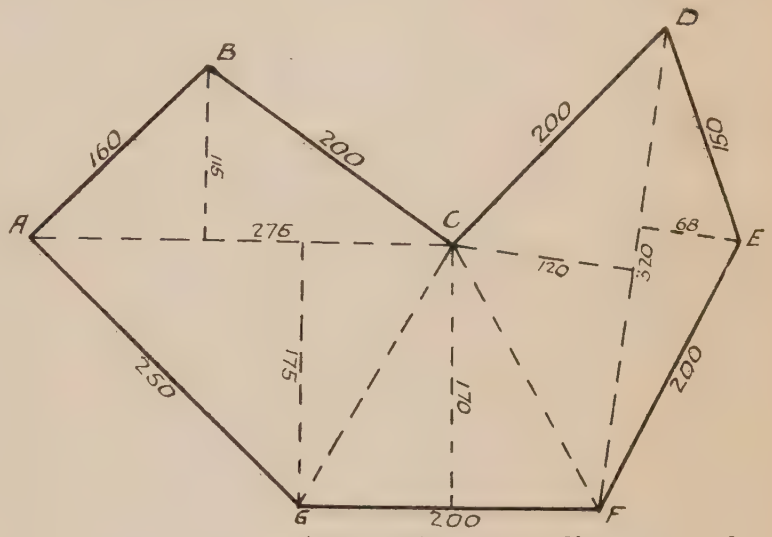
Approximate Methods of Farm Surveying.—Contd.

erally laid out rectangular parallel and then by dropping perpendiculars from one side to the other the necessity for taking angles is not so great, but with the irregular shaped hills, contours, streams, roads, and so on in this country it is practically impossible to get a reasonable idea on average farms of the areas of your fields unless you take the angles.

As I said before, fortunately our soils and lands not being very highly mineralised you can use the prismatic compass along the coast belt and within reason it will give you very accurate results. I would strongly advise anyone who is particularly interested and wishes to get the areas of his fields to use a prismatic compass for the angles. It is cheap—

Sketch Plan of
Field A.B.C.D.E.F.G.
Scale equals 100 Links equals 11 inch.

Area			
ABC	equals	275x115 equals	.31625
AGC	equals	275x175 equals	.48125
GCF	equals	200x170 equals	.34000
DCF	equals	320x120 equals	.38400
DEF	equals	320x 68 equals	.21760
			2 | 1.73910
			.86955 Acres.



you can buy a prismatic compass for a few pounds. A cheaper way of course is to get your neighbour to buy one and borrow it. (Remark "that is true co-operation" and laughter). As you know a circle is divided into four right angles of 90 degrees each, otherwise 360 degrees around the circle. To get an angle with the prismatic compass you sight through the prism, wait until the needle settles itself, and then read the angle on the edge of the circle. That gives the magnetic bearing of the line which you are taking. You then do the same thing on the other line and the difference between the two bearings is the included angle.

With regard to chaining, so far as survey work is concerned all measurements are reduced to the horizontal, so if you are chaining down steep ground a plumb-bob is necessary. Some people have an idea that there is very much more area of land in a hill farm than there is in a flat farm, for the reason that surveys are all reduced to the horizontal for survey work. As a matter of fact in practice the difference is very small except on extremely mountainous ground. To many people it is not so much the taking of the measurements as the working out afterwards which is the difficulty. Of course this is a business in itself and it would be absurd for me to attempt to demonstrate to you all the ways in which the areas of figures are obtained exactly.

You can get what you want with very little calculation. Presuming that you have done as I suggested and gone round with your prismatic compass and taken the angles and measured the lines with the tape, the simplest way to get at the areas is to plot your field work on paper to a fairly large scale; then divide the figure up into triangles or parallelograms, scale off the lengths of the lines and then work out the areas of the triangles (see diagram).

Some little time ago there was a dispute over the area of a farm, and two surveyors were concerned. A survey was made of the fields of the farm by the methods I have described to you to-day and the areas taken out as I have shown you. The people interested were not satisfied and the other surveyor was called in and an accurate theodolite survey of the whole area was made. The first man's work took a day and the calculating and planning took another day. The second man's work took a fortnight, and at the finish the difference in the result was half an acre in an area of 397 acres. Those are results which were actually obtained.

There is another instance: an estate had been surveyed into large areas of about 200 acres in each block by the methods I have described to you. It was necessary to go over these again and put in smaller subdivisional fields. One block was tested out and on a block of 200 acres when it was remarked out into nine fields the difference was half an acre. Of course that is not accurate surveying and is not meant to be, but for the average farmer it is as near as he is likely to get in the ordinary way.

Approximate Methods of Farm Surveying.—Contd.

Another reason for a fairly accurate farm plan is that it unfortunately happens with a number of sugar farmers that for various reasons they have to get valuations made of their farms (laughter). I don't wish to convey the slightest suggestion that I am in any way belittling the value of the valuators we have to-day. A careful valuator in making a valuation of a farm generally puts a little footnote to the effect that "the areas and quantities are those as supplied by Mr. —." He covers himself in that way naturally; he is not a surveyor and has not the time to measure up all those fields. In his valuation he covers himself by saying that he has accepted the figures with regard to area.

What he is really doing is giving the value of the cane on the area supplied to him by the party owning the farm. From a valuation point of view that may be alright, but it all hinges on the point that the areas may be right, and if the areas are not right you probably find that those valuations are not what they ought to be or what the valuator would make them had he the proper plan of the farm before him and knew the exact area of the fields. For that reason alone I think it is worth the consideration of the average farmer as to whether it would not pay him to get the area of his fields and a general plan of all his farm or estate made out reasonably accurately. (Hear, hear and applause).

Mr. D. L. Patrick: We have had a most interesting talk from Mr. Warner and I must say he got right there. It has often struck me as peculiar that although we weigh our cane on a weighbridge to the last pound when you come to the land on which it is grown very few of us have any accurate figures in regard to that part of it. You may be 10 per cent. 20 per cent. or even 30 per cent. out in your calculations. How can you arrive at your tonnage per acre if you don't know your acreage? There is not the slightest doubt about the correct way to do things. The method demonstrated by Mr. Warner is an extraordinarily simple one. It is a subject that the majority of us have fought shy of. We don't even know the exact acreage of some of our fields. It has been handed on to us and we have kept it and guessed at it. We owe Mr. Warner a hearty vote of thanks for his paper. (Applause).

Now I would like to ask Mr. Warner a question. The method of measuring is correct, but as a surveyor I would like to know where he would start with his measurements if he was surveying a farm for litigation purposes. Would he take it from a point on the outside of the field equal to the centre of the space between the cane rows, or would he start right up against the roots of the cane in the outside row?

Mr. Warner: I am glad that was asked because it helps to illustrate the need why an approximate method is all that is required for ordinary measuring up of cultivated lands. You will get quite a lot of controversy as to where a field ought to start and end. As a matter of fact you have no definite line. It is a matter of give and take in taking the reasonable acreage of the cultivated land. It helps to show that a very accurate method of survey would not only be expensive but would not fulfil the object for which it was done, for the simple reason that you are not working to definite marks as in the case of land surveys where you have beacons and land marks to work to. I should say that a reasonable point to start from would be at a point on the outside of the outer cane rows equivalent to the centre of the space between the rows. The edges of the fields are more or less irregular and the approximate methods would give you the result just as accurately as the other.

The Chairman then thanked Mr. Warner for his address. (Applause).

ANIMAL TRANSPORT ON SUGAR ESTATES.

(Paper by V. C. SCHWIKKARD, Field Overseer, Sugar Association Experiment Station.)

In common with other branches of the Agricultural Industry of the Union the question of Agricultural Economics plays an equally important part in the production of sugar cane, and planters are seeking ways and means of reducing the cost of production of cane per ton without impairing or reducing their general efficiency.

While it is generally agreed that the cost of Native Labour provides the highest proportion of the cost of production it will be found that the cost of draught animals forms a proportion almost as great.

As a result of the cost of production of maize investigations it was shown that the cost of ox labour formed 17.7 per cent of the gross cost of production of maize; more than one sixth—and the cost of draught labour in the production of cane does not appear to be any less; it is probably higher. In the absence of any reliable figures giving the cost of production of cane per ton in detail it is impossible to show, with any degree of accuracy the cost of draught labour beyond indicating that this cost forms a comparatively high proportion of the whole.

Of the various types of animal at present em-

Animal Transport on Sugar Estates.—Contd.

ployed in the Sugar Industry, first place in degree of numbers is occupied by the trek ox to the extent of about 85 per cent, followed by the mule to the extent of about 10 per cent and the remainder represented by the donkey to a negligible extent the horse.

The immunising of horses against horse sickness has not been yet brought to a stage of practical utility and until this stage is reached or other economical means of combatting this fatal disease is found, the employment of horses is not advised.

Owing to outbreaks of East Coast Fever from time to time and the consequent restricted movement of cattle in those areas, and on account of their low initial cost, donkeys have been substituted for oxen. Donkeys once they are acclimatised are immune or resistant to disease but from an economic aspect there is little to recommend them as draught animals. They are considerably slower than oxen, whilst they necessitate the employment of the same number of attendants, require a grain ration and housing and a great deal of patience on the part of the driver.

From both a practical and economical point of view horses and donkeys do not bear favourable comparison with either oxen or mules as draught animals on the coast and it is not proposed to discuss them any further beyond giving a few words of advice on the purchase of donkeys to those who for any particular reason contemplate their employment. Donkeys, other than those bred on the coast or introduced from the Low Veld of Natal, do not survive under local conditions. There is a case on record of a planter who brought donkeys from the Karroo because of their cheapness, and within three months not one survived.

South Africa is practically the only country today which has retained the ox as its main source of draught labour. In the majority of other countries of intensive agricultural development, the ox has been supplanted by either the horse or the mule. The Coastal belt of Natal and Zululand as far North as Matubatuba is the most intensively cultivated stretch of country in the Union. In Natal where cultivation is even more intensive than Zululand and where the more broken and hilly nature of the country does not lend itself to the extensive use of tractors, the question of grazing has become a serious problem and the feeding of the oxen employed more difficult and costly as time progresses.

One of the most important factors determining the employment of oxen on sugar estates is not only the price of the land but also the potential value of its productive capacity. After paying due consideration to this factor and many other factors which will be dealt with later, it is contended that the ox is no longer an economical source of draught labour on sugar estates and a few figures and observations are here collated in support of this contention.

By further reference to the cost of production of maize investigation it is found that the average cost of ox labour per day is about 4¾d.

As the average cost of maize land is considerably lower than the average cost of cane land and the cost of maintenance of animals is cheaper, this figure can be taken as a conservative estimate of the cost of ox labour in the cost of production of cane.

From figures obtained from planters of long standing who employ mules and from many personal observations, the cost of mule labour per day is estimated at not more than one shilling.

Now eight small mules are equivalent in energy to twelve oxen, i.e. eight small mules will pull the same load for which 12 oxen are necessary. Again mules travel much faster than oxen, consequently it follows that the mules will draw the same load in the same time a greater distance than the oxen. In order to give a practical illustration it is necessary to take some standard operation such as ploughing: 12 oxen drawing a single furrow hillside plough under coast conditions will plough ¾ acre per day, employing three attendants, viz: driver, ploughman and leader, each costing 2/4 per day or a total labour charge of 7/- per day. For purposes of comparison eight mules drawing the same plough under similar conditions and employing the same labour at similar cost will plough 1¼ acres per day.

By a deduction from these figures and from the respective cost of ox and mule labour per day it is seen that it costs 15/8 to plough one acre with oxen and 12/- with mules—a saving of 3/8 per acre favouring the employment of mules or about 23 per cent. Time saved is money saved and taking a further illustration from the figures quoted in the previous paragraph it will be found that it would take a team of 12 oxen twenty days to plough 15 acres while it would take a team of eight mules twelve days only to plough the same acreage. This saving of time 40 per cent in the case of ploughing, is of incalculable value to the planter especially when, owing to conditions of drought and other causes he has been unable to prepare his land at the proper time for the usual planting.

The maintenance of an adequate supply of labour is always a serious problem and in this direction mules also show a big saving in the number of labourers required. Properly trained mules can be controlled by means of reins thus eliminating the necessity of a leader. An illustration of the labour saved by the employment of mules in preference to oxen can be shown by making further analysis of the figures already quoted: to plough 15 acres with oxen would entail the employment of 60 units of labour and to plough the same acreage with mules employing (a) three attendants, would entail the employ-

ment of 36 units of labour a saving of 40 per cent (b) two attendants, 24 units of labour only a saving of 60 per cent.

Oxen cannot be worked continuously on grazing alone and in consequence require to be rested from time to time to enable them to recuperate and regain their condition. Unfortunately there are no figures available showing the number of working days per year, it is possible to work oxen, but an estimate of 60 per cent is considered a fair average; on the other hand it is possible to work mules continuously with very short or no periods of rest. It is considered that the percentage utility of mules on the basis of working days per year is about 90 per cent.

This factor of utility is most important when it is remembered that the demand for draught labour on sugar estates is constant throughout the year.

In the Spring more than at any other time of the year, it is essential that the draught animals should be in good hard working condition and fit for the heavy work demanded of them, but it is at this period when oxen are at their lowest utility value, on account of their low condition and strength caused by the lack of sufficient grazing and sustaining food.

Except under exceptional conditions of heat, it is possible to work mules throughout the day. Oxen on the other hand are soon affected by the heat and become distressed, when they should be outspanned immediately otherwise fatal results may follow. In consequence of the distressing effect heat has on oxen it is the common practice to work oxen during the cooler hours of the day only and cases have occurred during periods of excessive heat when the moon has been favourable that oxen have been worked at night instead. It may also be remarked that the employment of any animal in the rain is to be deprecated as damage results by chafing wherever the harness comes in contact and the use of the animals is lost until the abrasions are healed.

Feeding and Care of Oxen and Mules:—More oxen die from poverty every year than from any other cause which is a matter that demands enquiry and remedying. Overwork is a contributory factor but the main cause can be described as nothing short of slow starvation. Owing to the limited extent of the farms and the high price of land very little is retained for grazing purposes and what is retained is always the worst land which is considered unsuitable for the growing of cane, whilst even the grazing value of this land soon deteriorates. Cattle like all animals, select the more palatable grasses first. These grasses are invariably the most valuable and nutritious but have a peculiar shallow rooting system as a result of which with constant grazing they are pulled out by the roots and their total elimination ensues. The place of these grasses is taken by what is commonly known as wire grass—a most unpalatable grass of low feeding value except when grazed when very young.

During the Winter months practically the only source of food available is cane tops, which are very often burnt and little or no provision is made for the feeding of oxen at night. Any animal which is worked during the greater part of the day must be fed at night. While the purchase of fodder for the purpose of supplementing the food for the oxen is desirable it cannot be recommended on economic grounds, but during the cutting season it is possible to gather cane tops for this purpose. Where burning is practised these can be cut daily in advance of the cutters before burning. In order to secure the full feeding value of cane tops they should be chaffed up and fed to the oxen at night from mangers.

It has been observed that many planters merely broadcast the tops in the kraal or paddock—this method is obviously wasteful as the greater portion of the tops are trampled upon and destroyed. Now cane tops alone are insufficient for the proper sustenance of the oxen and the question of finding cheap supplementary foods arises. The planter is in the fortunate position that such foods are easily and cheaply obtained almost at his back door. The value of molasses as a stock food is not realised. Molasses is easily handled and can be obtained at a nominal cost from any sugar mill and its use as stock food cannot be too highly recommended. By mixing a judicious quantity of molasses with the chaffed cane tops in the manger is the best method of feeding this commodity.

In feeding molasses it must be recognised that this is essentially a carbohydrate food and contains very little protein and should be balanced by the addition of some food such as oil cake or cotton seed meal, rich in protein.

Few animals respond better to food feeding and care than mules and the planter who treats his mules properly will be repaid many fold. Where cane tops and indigenous sweet grass are available on the farm it is unnecessary to purchase fodder as these will prove sufficient. All cane tops and grass should be cut fresh daily—the former chaffed and fed from mangers and the latter placed in a heavy rack above the manger at a convenient height. As with oxen the addition of molasses to the chaffed cane tops is recommended.

A daily grain ration of about 3 lbs. per mule supplemented by ¼ lb. oil cake or cotton seed meal, given in equal quantities night and morning will be found to be sufficient. The grain ration can be fed in the form of either crushed mealies or oats.

Mules, if fed in accordance with the above directions will thrive and maintain their conditions under regular and constant hard work. As a paradox it has been observed that mules often lose condition

when rested. In order to maintain a constant supply of green food for the mules employed the planter is recommended to set aside a small area of cane sufficient to ensure a progressive supply of fodder after the first cutting is completed. Only a small area will be required when it is remembered that during the cutting season a plentiful supply of cane tops will be available, it being then necessary to make provision for the off season only.

Mules should be housed in an open shed or stable, with the sides which are exposed to the rain and prevailing winds, protected. The floor requires to be bedded down with a litter of grass or trash every night and removed in the morning where it can be conveniently dried and aired ready to be returned again at night. The grass of trash soon becomes unfit for bedding when it should be dumped into a pit or heap for future use as manuure.

The Type of Animal to Employ:—While the employment of mules is advocated in preference to oxen it is recognised that some time will elapse before oxen are supplanted by mules. They are therefore included in this survey.

Experience has proved that the ox showing any pretensions to breeding other than Africander or Zulu is quite unsuitable for draught purposes under coastal conditions. Oxen of this type are hardy, maintain their condition and are less affected by the heat. The supply of coast-bred or coast-acclimatised oxen is limited, but when obtainable their purchase is recommended in preference to oxen from other localities even at an enhanced cost of from £1 to £1 10s. per head.

When buying oxen from other localities the planter is recommended to buy only oxen from what are known as the gallsick and redwater areas of Northern Natal, such as portion of the Estcourt district and the districts of Ladysmith, Dundee, Newcastle and Vryheid. The best time to introduce cattle from these districts is during the months of June, and August. It is only during this period that such cattle can be introduced to the coast with any degree of safety, where gallsickness and redwater are so prevalent.

As a further precaution the oxen should be worked soon after arrival. The lower value of imported oxen lies in the fact that they take a season to acclimatise. Imported oxen, until acclimatised, do not maintain their condition and require to be rested frequently, which naturally reduces their utility value to a great degree during this period.

At the present time the mules employed in the Sugar Industry are almost entirely the small type ranging up to about 14½ hands in height, and up to this point the scope of this paper has been confined to the discussion of this type, but the question of the extensive employment of mule labour also opens up the question of the relative merits of the smaller type of mule and the larger type ranging from 15½ hands high and upwards. Apart from the compartively higher initial cost and slightly greater cost of maintenance there is no doubt that the larger type of mule is the more economical to employ. It is considered that six big mules are equivalent in energy to 10 small mules, and the quality of the work performed is higher.

Unfortunately the demand for the large type of mule is greater than the supply in consequence of which the prices demanded are prohibitive to the sugar planter. If mules of this type can be purchased at a price of from £25 to £30 they are recommended in preference to the small mule.

Since mule breeding is not practised on the coast the supply of mules is drawn from various parts of the Union. Similarly to imported oxen, mules take a season to acclimatise during which period their utility value is reduced as they do not maintain their condition.

By purchasing young mules, 5 to 6 years old the planter is assured of from 12 to 15 years service, before it is necessary to cast them. The employer of mules is also warned against purchasing unbroken mules unless he has had previous experience, the facilities and time to train them, otherwise he will have cause to regret his purchase. A well broken mule is always worth £2 to £3 more than the unbroken mule—at least to the sugar planter.

Owing to the incidence of horsesickness the immunisation of all mules employed is essential, but when purchasing the planter is recommended to buy mules which have not been previously immunised but to have the mules immunised on arrival in the district where they are to be employed, as it has been observed that the degree of immunity is higher when mules are immunised in the district where they are to be employed and it has been observed further that immunity is better maintained by housing them in an open shed or stable. The cost of immunising is about 10/- per head when performed by a Government Veterinary Officer and the time occupied to recover from the operation is about three weeks.

When introducing unimmunised mules to the coast it is necessary to do so after the horsesickness season is over otherwise there is a danger of the mules contracting the disease before they can be immunised or in transit. The most favourable time to introduce such mules is during the months of July and August.

When appointing a driver, the planter is recommended to exercise the greatest care in his selection, that not only is the Native accustomed to handling animals but knows how to treat them properly, and when a suitable driver has been found, to retain him for that purpose only as neither mules nor oxen tolerate the frequent changing of the driver, nor do they give of their best unless constantly driven by the same man.

THIRD DAY'S PROCEEDINGS.

FRIDAY, MARCH 27th, 1925.

(Chairman of the day: Mr. EDWARD SAUNDERS.)

The final proceedings of the Congress were held in the Council Chamber, Municipal Buildings, Durban, at 10 a.m. on Friday, 27th March, and took the form of questions and answers principally.

The Chairman of the day was Mr. E. Saunders, who in opening the proceedings, said:—

First of all I must apologise for the absence of the Chairman of the Association, Mr. David Fowler, who is in England. As you know Mr. Fowler took an enormous interest in this work. He, I think, was the originator of this Sugar Week which has been held for the last two years and I think we can all say that it has been a very successful thing indeed. Personally I am sorry to say that I was not in Natal during either of the other two Sugar Weeks which were held, and so had no opportunity of attending. With regard to this one we are now holding, the result of yesterday and the day before I understand has been most satisfactory in spite of the very inclement and bad weather conditions, and that what has been seen will undoubtedly tend to bring about what Mr. Fowler's object and ideas were in having a Sugar Week, and that is more close coordination and interest being taken in all sides of the industry for their mutual benefit and advantage.

This I think shortly is the object of the Sugar Week. It is to bring together the various sections of the industry so that ideas can be exchanged on all sides on all questions, both planters and millers, and the staffs of the mills and companies generally, and I think that undoubtedly that has taken place to a very large extent.

This year the programme has been somewhat changed and for two days at any rate it has been more of planters work and for the planters interests than that of the millers and the more technical side of the industry. To-day, however, there are a large number of questions to be answered and these questions will or should bring out many matters of great interest not only to the planting side but to all sides of the industry, and will I am sure produce much interesting discussion and be of great value. The questions will be proceeded with as they appear on the programme and there will be experts to deal with them all and the delegates will have an opportunity of expressing their views. There are a great many matters of extreme importance and interest to all.

I do not wish to detain you with a long speech, but I wish to say a few words on the general aspect of the whole position of the industry and then declare the meeting open. I think that we can consider, or at any rate I hope we can consider, that we are now starting on a cycle of good seasons after having gone through a cycle of most cruelly bad seasons, and if that is the case there is every reason to hope that the industry will forge ahead and become each year of more importance to the country.

I think there can be little doubt that as an industry the Sugar Industry in South Africa is probably the most, or at any rate one of the most, important agricultural industries that the country has, and everything that is possible to be done to foster the industry by those who are at work in it, and not only by them but by the Government and everybody concerned in the country, is not merely a matter which is of interest to the Sugar Industry alone but to the whole community, and I think that if this is realised and the fact that every possible encouragement should be given to the Sugar Industry as part of a general policy of industrial development of the country agriculturally and otherwise, it will be of enormous value in bringing out what we require, and that is a much increased development of this country agriculturally and industrially.

There can be no doubt that meetings such as this bring out and give prominence, in a way which is very difficult to do in most industries, to the importance of such an industry as the Sugar Industry and from that point of view I think that the public-

ity which is given through these meetings is of great importance and of great value.

Recently we had the Minister of Agriculture on the Coast. He paid special attention to cotton and sugar development, and I think that he was very much impressed as an individual. Now it rests with us not only to impress the Minister of Agriculture but the community generally as to the importance of our industry, and the necessity for encouraging not only sugar but all similar industries in the country. I now declare the meeting open.

QUESTIONS RELATING TO ENTOMOLOGY.

Replies by Mr. C. P. Van Der Merwe, Government Entomologist.

The Congress thereupon proceeded with its programme of questions and answers. The opening questions were read by the general secretary and replied to as shown below

No. 13.—What is the effect of the mealy bug on the yield and composition of sugar cane and what measures have been found effective for its control?

Reply.—It has been stated that in Egypt the effect of the mealy bug on cane is very serious, causing a great deterioration in the yield of sugar, and of the composition of the juice. In Louisiana another mealy bug that infects cane has been reported to cause a loss of about 30 per cent in the yield of sugar. In South Africa the mealy bug does not cause so much damage. Probably the Uba cane does not suffer so much from its attack as some other varieties. That the pest has some effect on the yield and quality of juice is, however, most likely; but the amount of loss can only be determined by carefully carried out experiments with clean and infected cane. Another point that may prove of importance is the amount of impurities introduced into the juice on account of the presence of the bug. One often sees canes almost black with a soot-like deposit. This is caused by a fungus that grows on the honey-dew excreted by the insect. All the impurities added to the juice must add to the cost of clarifying it.

In Egypt it has been recommended that the plant-cane be dipped in an insecticide to kill the bugs that are present thereon before planting. In Louisiana it was found possible to control the bug attacking cane there by destroying the Argentine Ant which protects the bug from its natural enemies. Neither of these remedies is recommended under our conditions. We have not got the Argentine Ant, and our mealy bug is not so dependent for its welfare on the protection of ants, being quite able to thrive without them.

As regards treating the setts for planting, in other countries cane is not kept without re-planting as long as here. After one or two crops the field is ploughed up again. By the time a field started with clean setts becomes badly infested it is also time to plough it again. Here the cane may remain for eight to ten years, and it is sure to have become infested from outside sources long before there is any intention of ploughing it up.

Mr. Patrick: I would like to know if you are carrying out any experiments at the present time with the object of finding out if the mealy bug has any effect on Uba cane?

Reply.—No, I am not.

Mr. Townsend: Are there any known cases where the mealy bug has attacked the Uba cane?

Reply.—The mealy bug is always found on cane; every planter almost has seen it. It is the white insect which gets on the cane. It is usually under the leaves when you strip them off. It attacks Uba but does not do so much damage to Uba as they say has been done in other countries. In Egypt it does very great damage.

No. 14.—"What insect pests for sugar cane from overseas would be the most dangerous to have admitted into this country? What measure is necessary to prevent such invasion?"

Reply: It is difficult to say just which cane pest would be the most undesirable introduction, as insects may behave altogether differently under new conditions. It is no rare experience for an insect hardly known as a pest in its native home, to become a most serious pest when transported to a new country where it is free from natural enemies which controlled it before. The only safe policy, therefore, is to exclude any insect that may feed on cane. There are pests that destroy the roots of cane, borers in the roots and stems, insect that suck the sap from the leaves and stems, others that devour the foliage, etc., and all those already known as pests, as well as those which may perhaps become pests, are to be excluded.

To prevent the introduction of insects that destroy the roots of cane, no plants are admitted growing in soil. To exclude the other pests, all setts imported are carefully scrutinised and then fumigated. Then the cane is grown for as long as may be considered necessary in quarantine, and frequently inspected to discover any insects that may have escaped detection at first.

The provision of a green-house is an additional precaution, as it prevents insects that may develop

Questions Relating to Entomology.—Contd.

on the introduced plants from escaping. The greater the importations of cane from overseas the greater the chance of some pest being overlooked, therefore there is the necessity to restrict introductions as much as possible, and only permit those which are really required to get desirable new varieties.

No. 15.—"Are any of the existing cane pests in this country likely to become a serious menace?"

Reply: It is quite possible, in fact almost certain, that some of our Native insects will in time take to sugar cane more than they do now. If we find some soft cane to take the place of the Uba it is very likely to suffer more from borer attack than Uba. I do not think, however, that growers need lose any sleep about the possibility of some native insect wiping out their crops. Though we know of many bad pests of cane in other sugar producing countries, and have every reason not to want them introduced here, we do not find that they have stopped sugar growing in those countries. Methods of growing cane at a profit have been devised in spite of their presence, and we may expect to be able to adopt methods of control for any serious pest that may appear in our cane.

No. 16.—"Can outbreaks of the Mystery Army Worm be controlled?"

Reply.—"It is quite possible to confine an outbreak of the Army Worm at reasonable expenditure; but one must be prepared for the outbreak when it comes. Every day lost in seeking advice or obtaining the necessary materials means extra work and loss, as the insects are so voracious and spread so fast once they have reached a certain age. The outbreaks come at such erratic intervals, that it is very likely to find the grower unprepared, often coming when least expected. It is more likely to appear in dry years, when a set-back to the cane is of more consequence than in years of good rainfall, and there is therefore the more reason why outbreaks should be controlled when they occur.

As soon as an attack is noticed, steps should be taken to confine it. The best method is probably to draw one or more furrows round the infested area and scatter poisoned bait at the bottom. The caterpillars are detained by the furrow, find the poison, eat it and are killed. The furrows may be used without the poison. The more care must be taken with them to see that the sides of the furrows towards the ground it is desired to protect are steep so that the insects cannot crawl out on that side. Holes should be dug in the furrows at intervals and filled up with soil as they become too full of caterpillars, and others dug. When it is not practicable to make furrows the poison bait may be spread among and in front of the advancing armies. Great care must be taken to keep fowls and other live-stock from the treated ground. When furrows have been poisoned they can be filled in, when the work is finished, by harrowing.

No. 17.—"What is the best method of dealing with the sugar-cane cut-worm?"

Reply.—This is an insect that appears when the young cane shoots are growing through the trash. The caterpillars hide under the trash by day and come up at night to feed. Apparently it is kept well under control by its natural enemies, and it is only where it finds the protection of the trash that it can survive in injurious numbers. The cane recovers after an attack, and it is still doubtful whether it will pay to adopt control measures against it. The caterpillars may be poisoned by scattering poison bait among the trash along the rows. Some relief may be obtained by removing the trash from certain rows and piling it at intervals between others. The caterpillars are afraid to go too far from their hiding places, and do not attack the shoots from which the trash has been removed.

Mr. Townsend: Is there any evidence to show that this cut worm has an injurious effect on young cane at that stage?

Reply.—I should say that is more for a practical cane farmer to answer. Speaking from a theoretical point of view it cannot be any good for the plant to lose its leaves; while the caterpillars are there it cannot make new growth as the leaves are eaten off, and that cannot be of any benefit to the plant. I cannot say just how great the effect is. It is an experiment that I hope to carry out some day to control it on a certain piece of ground and leave another piece of ground untreated and see what the difference in yield is between the two.

Mr. Townsend: Is the cane cut-worm the same as attacks the mealies?

Reply.—No, it is not. The cut-worm on mealies is of another species, although closely related. They are not really the same.

Mr. Townsend: You have found the cut-worm confine itself to trash, and that with burnt trash there is no cut-worm?

Reply.—No I would not say that. Trash is a protection to cut-worms. Birds eat them very readily and there are a lot of other parasites which go for them also. When they are in open ground these enemies make short work of them but under the trash they are protected to a certain extent. But of course even in open ground some are found protected under clods, leaves, etc.

Mr. Patrick: I take it that after the cane is cut and trashed a certain period of time elapses before you get any great number of cutworms; it takes a certain time to hatch out a great number of them. Supposing you lifted the trash from a row and pony ploughed that row and then put the trash

back, would a process like that keep back the hatching of the eggs in the earth? Would that be a method of keeping it down to any extent?

Reply:—I don't think it would. The eggs are very likely laid in the mulch on the trash so that when you lift up the trash you lift the eggs with it. It would be too expensive to lift the trash and put it back again.

Mr. Townsend: This is a question which has been with us for the last forty years. I may say that from my own experience, I have had burnt cane alongside of trashed cane, and I have found no trace of cut worms in the burnt cane. But the trashed cane has eventually overtaken the burnt cane although at the time there was a difference probably of a foot, but eventually the trashed cane overtook the burnt cane, if not improved on the burnt cane. I am inclined to think, judging from my own observations, that there is really no deterrent effect on the cane when it is tackled at that young stage. Although my experience is that it does help to handle the trash in the way suggested, I doubt whether it would repay for the trouble taken.

Reply.—In a case where the one field is burnt and the other is not, you could not compare the two because there is sure to be a big difference in the field that is trashed. The field that is burnt does not get all the humus and organic matter that the other gets. The damage may be small but it is sure in some way to hold the cane back. Some think it is serious, and others do not.

No. 18.—"Is the Aphis on sugar cane a pest of importance?"

Reply.—The ordinary sugar cane aphis (aphis sacchari) often appears in enormous numbers in sugar cane fields, and by sucking the sap from the plants they do a certain amount of damage; but it cannot be considered as serious. Remedial measures are not advised.

A much more serious aphis on cane is one, which, strangely enough, is very seldom found on cane, and only occasionally is observed multiplying on it. This is the maize aphis (aphis maidis) which attacks maize and several other grain crops and grasses. Its importance lies in the fact that it is the carrier of the serious Mosaic disease. Although it does not permanently live on cane it may feed a little when it settles on it, and it has been definitely proved that it may carry Mosaic by first feeding on a diseased and then on a healthy plant. Unfortunately it is not possible to control it, but Mr. Storey can tell you more about that.

Note on the Preparation of the Poisoned Bait Referred to in Questions 16 and 17.

The bait may be prepared from bran or from fresh green grass, sugar cane tops, etc., sweetened with sugar or treacle and poisoned with arsenite of soda. Bran, if available, is the best thing to use, as it can be conveniently handled and is easily spread out thinly. One pound of arsenite of soda is thoroughly dissolved in sixteen gallons of water and also two pounds of sugar or two quarters of treacle. Where treacle is plentiful it may be used more liberally. The liquid is then used to moisten the bran or green stuff. The bait must be thoroughly moistened; but must not be sloppy, so that it can be readily distributed. Sixteen gallons of poison should be enough for 150 lbs of bran or 200 lbs. of green stuff.

In moistening bran with the poison it should be put in a heap on the floor, and the liquid slowly added, while the heap is being stirred, until the whole mass is thoroughly moist; but not so wet that it cannot be readily scattered. Green stuff is best dipped in the liquid and then allowed to drain, till all the surplus moisture has run off.

The Chairman expressed the thanks of the members to Mr. Van der Merwe for his interesting replies to the questions put to him.

QUESTIONS RELATING TO IRRIGATION.

(Replies by Mr. G. A. Ritchie, Circle Engineer, Natal.)

Question No. 19.—"What increase in crop can be expected from irrigation?"

Reply.—If we irrigate cane in this country we may look for an increase in the crop in two directions:—

(a) We may expect to cut a greater weight of cane per acre.

(b) The interval of time between cuttings will be shorter due to the quicker growth and ripening of the irrigated cane.

(a) At Mount Edgecombe in the 1923-24 season the Natal Estates cut from three irrigated fields a total of 3,006 tons of cane and as the area of these three fields totalled 56 acres the yield was at the rate of 53.7 tons per acre. When these same three fields were previously cut as not irrigated plant cane the same area gave a yield of 1362 tons or 24.3 tons per acre; so that in this case irrigation seems to have accounted for an increase of 29.4 tons per acre in spite of the fact that during the season these fields were cut as dry cane the annual rainfall was 52 inches where the rainfall for recent years was as follows:—

1923.—26.59 inches.
1924.—30.69 inches.
1925.—24.00 inches for first three months only.

Questions Relating to Irrigation.—Contd.

Again in the 1924-25 season plant cane was cut on this estate from a certain area of 77 acres giving an average yield of 39 tons per acre, whereas when these same fields were previously cut as not irrigated plant cane they yielded only 22 tons per acre, so that in this case irrigation gave an increase in yield of 17 tons per acre. This increase is less than that obtained in the previous season, but then the 1924-25 season was one of exceptional drought, and water for irrigation was very scarce, consequently the applications of water were much smaller than they should have been.

(b) During the last cutting season 42 acres of first ratoons were cut on the Natal Estate after being irrigated. This cane was cut at only 12 months old and gave a yield of 21.1 tons per acre. During that season the average yield of non-irrigated first ratoons for the whole of the Estate was 18.3 tons per acre, cut at two years old. So that, due apparently to irrigation, the 12 months old first ratoons gave an extra yield of 2.8 tons per acre over the not irrigated 24 months old first ratoons.

It must be again pointed out that the above mentioned increases in the yields of irrigated over those of not irrigated canes were obtained under adverse circumstances because during the 1923-24 season this estate was only in the experimental stages with regard to irrigation, and in the 1924-25 season water for irrigation was very scarce due to the protracted severe drought.

Judging, however, from their experience during these two seasons this estate considers that on the average we can in this country expect irrigation to give us an increase of from 15 to 20 tons per acre of Uba cane.

Mr. G. H. Hulett: I would like to know what the cost of irrigation is per acre.

Reply.—In this particular case I have not the actual costs of irrigation, but I must point out that in the case of Natal Estates the costs are going to be extraordinarily high as they have practically no facilities for irrigation. They have no big streams running through their estates. They first had to dam up and build an expensive dam and store the water, and then they have to pump water from that under severe conditions. So that their costs are very much higher than the average planter's would be . In many cases in the sugar belt I am certain that irrigation could be obtained at a very small cost compared to the cost of Natal Estates.

Chairman: Do you think that irrigation as a proposition is one likely to be applicable to the coast of Natal as a payable proposition, taking into account the facilities that exist?

Reply.—I was rather going to discuss that in one or two of the questions. I will refer to it later.

Capt. Greig: I take it you will be able to give us data as to the number of inches of water used to produce that result.

Reply.—Yes I will, under another heading.

Question No. 20.—"What types of land in Natal and Zululand are most suitable for irrigated cane?"

Reply.—The land upon which cane is grown in Natal and Zululand may be classified broadly under two headings:

(a) Alluvial Flats.

(b) Hillside slopes.

(a) Alluvial flats will constitute the smaller proportion of the cane bearing lands, but in general the soil on such flats will be deep and rich, the land will be lying at a low elevation relative to the water supply, so that irrigation water will be obtained for it by means of comparatively cheap gravitation schemes or by pumping schemes where the water has to be lifted only a small height and such lands will usually lie at even flat grades so that the irrigation water would be easily and economically applied. Therefore, on such soils we could expect an enormous increase in yield due to irrigation especially if thicker softer types of cane than Uba were cultivated.

(b) Hillside slopes consist of various types and depths of soil. On hill side slopes irrigation will be more expensive especially where the water has to be raised to a considerable height by means of pumping. The difficulties and cost of applying the water to the crop will increase with the steepness of the slope and in general it is probable that it will not pay to irrigate the upper portions of steep hillside slopes unless the soil is very fertile and deep, for after all the ultimated limit of the weight of crop over a long period of years depends upon the amount of plant food it can obtain from the soil. Irrigation can only help the plant to extract the food available and cannot be expected to create that food where it does not already exist.

Question No. 21.—(a) "What is the optimum quantity of water to apply. (b) What is the best practical method of measuring the amount of water applied? (c) What is the best method of applying the water to the crop?"

(a) In Hawaii where cane is irrigated the crop is given up to 100 inches of water, whereas our cane gets something like an average of 38 inches per annum of effective rainfall. Under an ideal system of irrigation it would be best to give the crop in its earlier stages small applications of say only one inch of water every week, gradually extending the intervals between waterings up to say 4 weeks and at the same time increasing the amount of water gradually up to three inches per application. Then for a couple of months before cutting no water should be needed. No hard and fast rule, however, can be laid down as the optimum quantity of water will depend in each locality upon the nature, depth,

Questions Relating to Irrigation.—Contd.

and lay of the soil as well as upon the climatic conditions as regards rainfall, sunlight, and winds.

The Natal Estates after irrigating for two seasons conclude that a two year crop should receive from 40 to 50 inches of irrigation water and a one year crop from 30 to 40 inches.

In applying water to a crop there is usually a considerable percentage lost in the supply canals and in inefficient water leading, so that when deciding to give an application of three inches nett it is usual to provide water enough for a gross four inch application so as to cover these losses. The ideal method of measuring the amount of water applied to a crop would be by means of recording water meters but in most cases such a method would not be practicable.

An easy and accurate method is first to deliver the water to a service reservoir the capacity of which at all levels is known. The water is then run from this reservoir to the crop, the level of the water in the reservoir being noted before and after the operation, thus telling the total amount of water used for that area. If the water is pumped directly to the crop and no service reservoir exists then knowing the capacity of the pump and the speed at which it is working the amount of water delivered in a given time may be easily calculated, but the accuracy of this method depends upon the even running of the pump and its efficiency, and as the plant ages this method becomes less and less accurate.

Perhaps the easiest and simplest method in comparison with its accuracy is to install either permanently or temporarily, gauging weirs in the supply furrows. Such weirs are very simple and are fully described in the Bulletin entitled "The economical use of water in irrigation" which may be obtained from the Irrigation Department by asking for it. For the purpose of irrigation on anything like a large scale the gallon per minute is an awkward unit and the cusec or cubic foot per second is more convenient.

The following figures may be found useful in dealing with quantities of water:—

One cusec equals 374 gallons per minute (very nearly).

One inch of water spread over one acre equals 22,700 gallons (very nearly).

One cusec flowing for one hour on one acre would give it a one inch watering.

(c) Where the cane is grown on alluvial flats or on gently sloping ground the cane rows should be run diagonally across the slope, making the grade such that the irrigation water would run down between them without scour on the one hand or without damming up on the other. The supply canal would run along the top edge of the fields at such a grade as to carry the desired volume of water but not at such a speed as to cause scour. Small streams of water would be allowed to run out from the supply canal into several of the cane rows at a time, the number of cane rows thus served at once depending upon the flow of water in the supply canal.

Where the cane is grown on steep hillside slopes the distribution of the water becomes more difficult. In this case there are two general methods of application:—

(1) The supply canal runs along the top edge of the field on the side of the slope at a flat grade and the cane rows run directly down the hill. Tiny streams are taken out from the supply canal and allowed to run down between each cane row or between each alternate row.

(2) The supply canals run down the steep slope at intervals of about 10 yards and the cane rows are run on level contours, the water being diverted from the canals into these level rows.

The first method (1) is probably the cheaper to install. The supply canal is easily made because it runs on a flat grade, so that there is no undue tendency to erosion. The cane rows run up and down the slope and perhaps it is an easier agricultural operation to place them so than on the level, but in applying water by this method great care must be exercised in allowing only a very small runlet down each row and if a large flow of water is being used so as to serve the field quickly then many rows must be watered simultaneously so that a considerable number of skilful water leaders will be required in order to control the water without risk of severe erosion accompanied with the loss of valuable fertiliser. This danger of erosion may be somewhat lessened by running the rows diagonally down the slope so that their grade is not so steep as if they were run directly up and down the hillside.

In the second method the rows are planted as far as practicable on level contours, and at intervals of about 100 yards supply canals are run straight down the slope crossing the cane rows. Small streams of water are then extracted from the supply furrows and are allowed to run between each cane row or each alternate row. These rows if quite level would then quietly fill up with water, acting as small long narrow dams. When it was considered that each row had received enough water the supply would be shut off and admitted to another row.

If water be run between each alternate cane row then each row is still in contact with water and this advantage exists that if the lower ridge of a watered row were to break at some weak spot the water from it would escape into an empty row and so would not tend to overflow its lower edge with consequent risk of erosion.

This second system of applying the water gives greater control of the operation with consequent

Questions Relating to Irrigation.—Contd.

smaller cost of labour in water leading and less risk of loss due to erosion, but it is more costly to instal. Planting the rows on the contour will perhaps be a little more difficult than having them up and down, but of course the contour ploughing has other advantages, such as the better conservation of the natural rainfall. Since the supply canals carrying a fair flow of water will be running down a steep grade they will have to consist of pipes or lined channels and where each row is to be watered from these channels a small valve or sluice-gate will have to be installed.

Of course the ideal method of applying the water to the cane would be by means of a sprinkler system with overhead pipes so that all operations could be carried on below them. In such a system there would be practically no waste of water; as small an application as desired could be given evenly and accurately. The labour costs of such distribution would be very low and the danger of erosion or of waterlogging the soil would be practically eliminated. The expense of such a system is of course against it. Stewarts and Lloyds are agents for an English sprinkler system where the cost can be somewhat lessened by making some of the pipe lines portable, and Barker & Smith of Maritzburg will quote for the Nunan System as used in Australia. In this system the pipes consist of ordinary light galvanised iron pipes as used in carrying the water down from the roof of a house, thus making the system cheap in first cost and very portable.

Question No. 22.—"Is irrigated land liable to become water-logged?"

Reply.—Reasonable care must be taken in irrigating any crop or the lower lying parts of the land will become water logged and spoiled. Cane, however, can perhaps stand more water than any other crop. Hillside lands will usually drain well due to their steep slope, and the alluvial flats in the sugar belt are nearly always fairly narrow and close to a stream into which any excess water can easily drain naturally, so that the chances of sugar bearing lands in this country being soured by irrigation are very small and in the few places where the tendency may exist the drains to remedy the trouble can almost always be very easily made.

Mr. F. W. Bartch at Fort Tenedos on the northern side of the Tugela river a short distance below Bond's drift has had cane growing for about six weeks practically in a swamp, in spite of which it came to maturity and gave a good yield. Some of his best cane is grown on the alluvial flats on the Tugela river. The level of the surface of these flats is only a few feet above the water level in the river so that the cane roots must be very nearly under water. On these flats Mr. Bartch has reaped heavy crops of cane, cutting five times in six years.

Question No. 23.—"Would other varieties than Uba better repay the expense of irrigation?"

Reply: Uba is essentially a small hard virile cane. The general conditions for cane growing in this country are: shallow soils on steep slopes which dry out easily, scanty rainfall, and a latitude rather far from the tropics. Under such conditions Uba is perhaps the only variety which can exist. If, however, the conditions could be very much improved say by selecting the better deeper soils, and supplementing the small irregular rainfall by means of irrigation, then it is almost certain that these improved conditions would support a much more profitable variety of cane than Uba, and allow it to afford very heavy yields of healthy cane.

In all cases of agriculture we see that under poor conditions the only plants that can survive are those approaching the wild original types and these plants naturally have very little fruit bearing value, but as conditions are improved the more artificial types of the plants, in spite of their greater susceptibility to disease, etc., can be grown successfully and yield a much greater profit.

Question No. 24.—"Will irrigation during the winter months accentuate any tendency to damage from frost?"

Reply: During very dry winters we notice that the cane growing in low lying hollows tends to suffer from frost. During a cold winter night the general temperature of the air tends to fall below freezing point, but the temperature of the water in the Indian ocean will remain above freezing point. The higher parts of the land exposed to breezes from this warmer water will not get frost, but the hollows which do not get these breezes will freeze if not protected by some insulating blanket.

When the ground is moist, water evaporates from it, forming a layer of water vapour in the air for some feet above the ground, and this water vapour affords enough insulation to prevent the temperature of the air in contact with the crops falling below freezing point. If however, the ground be dry, then this layer of water vapour will be absent or not thick enough to save the crop from being frost bitten. From this argument it seems likely that irrigation during the winter months will tend to protect cane from frost rather than render it subject to it.

Question No. 25.—"What would normally be the cost of installing pumping plants to irrigate respectively say, 50 acres, 100 acres, and 200 acres of cane?"

Reply.—Of course it is impossible to give an answer to this question which will fulfil all cases becauses each particular proposed pumping scheme should be investigated separately. However, I have obtained figures for suppositious cases in all of

Questions Relating to Irrigation.—Contd.

which I have assumed that the following conditions are the same:—

The application of water is to be three inches nett or four inches gross to allow for losses. The plant is to work eight hours per day for six days per week, thus allowing time for adjustments, repairs, etc. The water is to be raised up a vertical height of 100 feet (not including the friction head in the pipe). The rising main is to be 1000 feet in length.

For the average planter's schemes these conditions would be rather severe and would result in costly outfits, but they have purposely been chosen on the high side so as to show the maximum cost of pumping schemes rather than the lower costs. In calculating the discharge of the pumps for the various sized schemes it has been assumed that in the case of the scheme to serve 50 acres the gross application of four inches must be applied in three weeks with the plant working eight hours per day for six days in the week.

In the 100 acre scheme the whole area is to be served in five weeks of six eight hour days per week. And in the 200 acres proposition the time for irrigating the whole area is to be eight such weeks.

Of course if the time allowed for the irrigation of the desired area were extended, the required discharge of water from the pump would be less and a smaller powered and so cheaper engine would suffice.

Table No. 1 (which is appended) shows the ideas of several Durban firms as to the type and cost of plants which would fulfil the conditions imposed by these supposititious schemes. The operating costs of pumping for irrigation have been kept by the Natal Estates on three schemes where the pumps are driven by electric motors. Their report for the week ending 27th February, 1925, shows:—

Area irrigated 99 acres; average application 2.55 inches; cost per inches of application for field work pump attendance, etc., 10s. 8d. per acre; for electric current 4s. 6.4d. per acre.—Total, per acre 5s. 5.2d.

On one scheme served by a 40 h.p. suction gas plant driving a six inch centrifugal pump the same report shows:—

Area irrigated 19 acres; average application 2.3 inches; cost per inch of application for field work, pump attendance, etc., 1/10d. per acre inch; fuel, lubricants, etc., 1s. 1.3d. per acre inch.—Total per acre inch 2s. 11.3d.

They say that the greater expense of the electrical power more than compensates for the trouble in running the suction gas plant.

Mr. Patrick.—Talking about losses what are the losses in an unlined furrow?

Reply.—The furrow loss is not much in a pumping scheme. The loss is rather in the application of the water. If you say you will give a field of 30 acres a three inch watering, probably some parts of it are only getting one inch and some six inches. Where it is getting six inches it is getting far more than it requires. That water is lost and wasted. That is where a more expensive system pays.

Mr. Patrick: What would you put the total loss at?

Reply.—It depends entirely on circumstances. Where I want three inches I give four, that is about 33 per cent.

Question No. 26.—"Are there cheaper schemes for irrigation than pumping schemes?"

Reply.—Pumping is probably the most expensive way of obtaining water for irrigation, but in many cases water can be diverted from the higher reaches of a stream and be led by means of a canal system to the lands to be served. Each scheme must be treated on its own merits as there is a much greater variety of such schemes than of pumping schemes.

Mr. Townsend: Supposing a furrow of the class described was necessary, are there any provisions similar to the Fencing Act whereby the other owners of the land would have to bear their proportion of the cost of digging the furrow?

Reply.—No. In this case it seems a little unfair at first sight, but the object is the greatest good for the greatest number. The owners of the previous farms can sit on the fence and allow the other man to go to the expense, and then if it is a success they can claim their share, but in that event they have to pay their share of the expense.

Mr. Hamlyn: The Government has been approached to effect a remedy in the law as it stands at present.

Question No. 27.—"Does it pay to drain swamps and then plant cane on the reclaimed land?"

Reply.—There must be thousands of acres of swamp in the sugar belt capable of being turned into very rich sugar lands by means of drainage, these swamps now being only a menace to health. The Gledhow Estates at Stanger are considering the drainage of the M'Bazamo Swamp some 200 acres in extent. Mr. F. W. Bartch has drained several small swamps on his farm Fort Tenedos and is so pleased with the results that he now intends reclaiming a swamp some 200 acres in extent.

Question No. 28.—"Does a drainage scheme give rise to the danger of soil erosion?"

Reply.—It is only in very exceptional cases that cane lands in this country will need drainage due to irrigation. Soil waterlogged due to natural conditions may sometimes need drainage. the provision of which is usually a simple matter. Soil erosion on the other hand may easily occur when irrigating cane on steep slopes unless good methods and careful water leading are resorted to.

IRRIGATION SCHEMES FOR PLANTERS.

TYPE AND COST OF PLANT REQUIRED.

(TABLE NO. 1.)

50 Acre Scheme.

Name of Firm.	Pump.	Piping	Engine.	Estimated Cost of Scheme.			
				Plant f.o.r. Durban.	Erection and Housing	Total	Running costs for Fuel and Lubrication per 8hr Day
Thos. Barlow & Son.	5" Tangye Centrifugal.	8" Steel.	35 h.p. Tangye Heavy Oil.				6/-
Collingwood & Beckwith.	3" Worthington.	4" W. Iron.	Crude Oil. 30 B.H.P.				25/-
Reid Bros.	6" Mather & Platt Centrifugal.	7" Hume Concrete.	24-28 B.H.P. Petter Crude Oil.	£733	£75	£808	6/7
Rogers—Jenkins.	No. 6 Goulds Centrifugal.	7" Black W.I. S. & S.	42 B.H.P. Ruston Crude Oil.	£1,035	£150	£1,185	7/6
Stewarts & Lloyds.	44" Gilks Centrifugal.	8" Steel.	30 B.H.P. Crude Oil	£850	£250	£1,100	6/4
"	"	"	Suction Gas	£900	£300	£1,200	12/4

100 Acre Scheme.

Name of Firm	Pump.	Piping	Engine.	Estimated Cost of Scheme.			
				Plant f.o.r. Durban.	Erection and Housing	Total	Running costs for Fuel and Lubricants per 8hr. Day.
Thos. Barlow & Son.	6" Tangye Centrifugal.	9" Steel.	Tangye 47 H.P. Crude Oil.				8/-
Collingwood & Beckwith.	4" Worthington Centrifugal.	5" Wrought Iron	40 B.H.P. Crude Oil.				30/-
Reid Bros.	7" Mather & Platt Centrifugal.	8" Hume Concrete.	28-30 B.H.P. Vickers—Petter Semi-diesel.	£853	£89	£942	7/7½
Rogers—Jenkins.	No. 6 Goulds Centrifugal.	8" Black WI. S & S.	42 B.H.P. Ruston Crude Oil.	£1,290	£150	£1,440	8/-
Stewarts & Lloyds.	6" Gilks Centrifugal.	9" Steel.	46 B. H. P. Crude Oil.	£1,150	£250	£1,400	10/1
"	"	"	Suction Gas 46 B.H.P.	£1,200	£250	£1,450	16/8

200 Acre Scheme.

Name of Firm	Pump	Piping	Engine	Estimated cost of scheme.			
				Plant Durban f.o.r.	Erection and Housing	Total	Running Costs for Fuel and Lubricants Per 8hr. day
Thos. Barlow & Son.	8" Tangye Centrifugal	12" Steel	55 B.H.P. Tangye Heavy Oil.				10/-
Collingwood & Beckwith.	6 inch Worthington Centrifugal	Wrought Iron.	67 B.H.P. Crude Oil				45/-
Reid Bros.	10" Mather & Platt Centrifugal	10" Hume Concrete.	36-42 B.H.P. Petter Semi Diesel Crude Oil.	£1,116	£110	£1,226	9/10½
Rogers—Jenkins.	No. 6 Goulds Centrifugal	10" Black WI. S. & S.	70 B.H.P. Ruston Crude Oil.	£1,600	£175	£1,775	14/-
Stewarts & Lloyds.	6" Gilks Centrifugal	12" Steel.	65 B.H.P. Crude Oil.	£1,450	£300	£1,750	14/-
"	"	"	Suction Gas 63 B.H.P.	£1,500	£350	£1,850	23/3

QUESTIONS RELATING TO GREEN MANURING.

Questions No. 29.—"What are the most promising crops to grow for green manuring in Natal; (a) for winter planting (b) for spring planting?"

Reply.—There are many green manure crops that can be recommended for planting during the spring and early summer. Several of the legumes will make excellent growth at this period such as velvet beans, cow peas, mung peas and sunn hemp. Buckwheat will also make vigorous and rapid growth at this season.

The difficulty is to find plants which will make growth during the dry months when planted late in the season. Buckwheat, however, appears to do well even when moisture is deficient, and it was found at Cedara that lupins planted in March gave good yields. Other deep rooting plants, such as rape are being experimented with during the present season. Natal Estates Co., state that velvet beans, including Mauritius bean, will do well before the rains become plentiful once the colder weather has been passed.

Mr. Townsend: On the question of cow peas, what do you consider is the proper time to plough them in? We have had a good many differences of opinion, whether it should be at the flowering or whether when the seed pods are just ripe and whether the advantage is not the same if you allow the crop to mature, reap the seed, and then plough the residue in.

Reply.—I believe that time is a great factor in a green manuring system. The idea is to give as much organic matter to the soil in as little time as possible. The best time would appear to be as soon as the plant has made its maximum leaf growth, and that is usually at the flowering stage. There is another advantage in ploughing in at this stage, and that is that it decomposes the more readily in the soil. Consequently the land becomes available for further planting more rapidly. Of course if the idea is to procure seed it is necessary to leave it in the ground a further period, and as was stated yesterday with some of these plants which have not become acclimatised to Natal coast conditions it may be advisable for the planter to grow his own seed. In some cases he has to because the seeds are not obtainable at all.

Some of the crops have not been grown under Natal coast conditions. But for green manuring I would recommend ploughing it in at the flowering stage. There is an exception, though, to that in the case of the crop we saw at Umbogintwini of sunn hemp. That, as was noticed, made a very tall growth; it had grown about six feet before it had flowered and reached its maximum growth. That is a very vigorous plant and at that stage the fibre which is formed is rather tough and must take a considerable time to decompose. Under those conditions I would recommend ploughing in sunn hemp before it reached that stage of maturity, say when it is about three feet high, which would occur under normal conditions after about five or six weeks growth.

Capt. Greig: When growing a crop of beans in heavy clay soil do you recommend ploughing that crop in green or waiting until it dries out and then plough it in; it is the ordinary red bean.

Reply.—I think the best practice would be to plough it in while it was still green. There may

be a temporary increase of soil acidity during the decomposition of the plant, but it is found that that soon passes off and usually within three weeks or so it is safe to plant some other crop.

Mr. Hamlyn.—After you have planted your fields say in the autumn would it be detrimental to put in buckwheat between your furrows with the object of ploughing it in when you scarify at the commencement of spring?

Reply.—As I mentioned yesterday, it would seem to me that the best plan when ploughing out old cane is to sow a crop of buckwheat as early as possible, for the reason that that is one of the few plants that will germinate before the beginning of the rainy season and will give your system of green manuring a start. As to planting between the rows, I am of opinion at present that it is not advisable to grow anything between the rows of plant cane in this country.

In Louisiana it has been the practice to sow mellilotis indicus because the cane although planted in the autumn does not grow during the winter and does not appear above the ground until the following spring. Consequently they have several months available during which they can grow green manuring crops during the winter. Here we have not those conditions. What we require to do here is to encourage the development of the plant cane as early as possible.

Anything which tends to hinder its development whether by drawing on the reserves of plant food in the soil or by shading the plant, to my mind is harmful. For that reason I would not grow any green manuring plant among the plant cane and still less any catch crops such as beans or sweet potatoes, as is sometimes done.

Questions No. 30.—"Is the superiority of legumes over non legumes as green manure crops likely to be so marked in this country as is the case elsewhere?"

Reply.—The application of non-leguminous green manure crops such as buckwheat, rape and others would appear to be particularly promising in this country, where nitrogen does not appear to be as a rule the dominant fertiliser requirement of the soil. In most other sugar growing countries nitrogen is principally required, but that is not the case here in those soils which are well supplied with organic matter. The first requirement in this country would appear to be a plentiful source of humus together with a supply of phosphate.

Mr. Dodds was also asked whether he could mention any other country where the conditions were similar to those in Natal.

Reply.—South Africa is unique in a great many respects. Among sugar growing countries I don't know of any where the conditions very closely resemble the conditions here.

Question: Is it not then a fact that the only experiments that have been made in sugar growing have been made at Cedara where conditions are entirely different to the sugar belt?

Reply: The only experiments on sugar cane growing for sugar production which have been published and are generally available are those at Winkle Spruit, but experiments with other crops not only at Winkle Spruit but Cedara and Weenen have been carried out, and the same conditions were found. The application of mineral nitrogenous fertiliser except in very small quantities of mixed fertiliser, was found to be unfavourable as a rule. This is essentially a matter which calls for further investigation and we have commenced a few experiments in this direction.

QUESTIONS RELATING TO AGRICULTURAL PRACTICE.

Question 31.—"Realising that cane is deep rooting and occupying the soil for several years, what main points should be considered in preparing the soil for cane planting?"

Mr. Fisher stated that he would rather that some members of the audience would start the answer to this question and that the question be discussed and he would then sum up the position. By so doing he thought they would get much more information than if he was to reply straight off.

Mr. Patrick: The first essential in my opinion as an amateur is your method of ploughing. Merely scratching the ground is useless because you don't break up the ground to the required depth to allow the roots to go down. The ideal method of ploughing to my mind is to plough we will say twice, first breaking your soil to a depth of eight inches. When you have harrowed that down and it has been assisted by the weather you should then cross plough it to a depth of say ten inches.

When you have worked that down into tilth to go a further depth of say twelve inches. The idea of the further depth of course is to break up the subsoil in such a way as to allow the roots of the cane to penetrate, and by so doing you get a big reserve of moisture for your droughty years and you allow a bigger working place for the bacteria that supply the plant with food. It would be advisable if one was not limited by the cost to plough perhaps only ten inches and do the further depth by the method of sub-soiling, but to most planters that is impossible. I think if you have three successive ploughings and finally add a depth of twelve inches you are going to get a fairly good result. The main point is that you get a decent tilth, you get moisture reserve in your soil, and you have broken up

the ground fairly deeply for the penetration of the roots. That is my idea of ideal conditions.

Mr. G. H. Hulett: There has been controversy I think in the agricultural papers on the question as to whether deep ploughing is better than shallow ploughing. I am dealing with virgin soil now. I hold that the first ploughing should be six to eight inches and then you cross plough to break your sods, and of course while cross ploughing probably your ploughs will go down a little deeper and then you harrow and fallow. In dealing with virgin soil that would be better than stirring up the sub-soil to get your surface soil. I have experimented on those lines. Of course I admit that different classes of soil would affect your judgment in regard to the depth of ploughing. I am rather in favour of surface soiling only with fairly good soils.

Mr. Townsend: We are all novices at this game, but I have had a pretty long experience at preparing soil for cane, and I think the first essential in ploughing up a field is to preserve as much as possible the green growth that is already in the field, not to chop it down and burn it away as a lot of people often do, but to dig it down where the plough won't take it and turn it into the furrow as the plough goes along. If we follow that we will conserve a great deal of the humus which is being wasted to-day. If you are a farmer and not a jobber you will see that your farm is properly ploughed and that there is not a single inch in waste. Every furrow should go through and turn the sods right over.

I have been through many fields and I am afraid that is a system which is very little observed. The idea is to get over the ground quickly and you see yards of ground that has not been touched. If you turn your sod down and the grass is turned underneath you want to follow that by harrowing and cross ploughing as early as possible. To my mind a third cross ploughing is unnecessary and is an unnecessary expense. The idea is as much as possible not to disturb your soil after ploughing it, so as to allow the decomposition of the vegetable matter and the growth of bacteria in the soil. You can only do that by allowing your soil to remain in a dormant condition without disturbing it continually. If not you will destroy the bacteria life and reduce the value of that land when you come to plant.

If you have a second growth of weeds which you think will be valuable plough them in also and harrow down after that. Make use of every bit of green stuff. Having completed that, your soil is prepared for cultivation. One of the most essential parts in preparing ground for cultivation is to see that any surface moisture that is likely to turn your ground sour is led away before you attempt to furrow. Any moisture hanging about will retard the fertilising of that soil.

Mr. Staniland: In connection with sub-soil, you don't need to trouble much about sub-soil when you plant a tree, but when you plant cane I want to know how long the sub-soil takes to become effective so as to produce nutriment to the cane. How long does it have to remain exposed to the atmosphere before it is of full value to the plants that are in the ground. Then again what depth of sub-soil would you turn over say for one season? I take it that sub-soil must be left exposed for a certain number of months at least before you can return and cultivate the ground.

Reply by Mr. Fisher: I think the points have been largely covered by the different speakers. I would like to put it to you in this way. That the soil is the plant's home and that in the preparation of the soil for the putting in of the plant we must make that soil as suitable as we can for the growth of a living organism in the soil. Now just as we in our dwelling houses like plenty of air for example, a certain amount of moisture, kept under control, and a certain something in the storeroom also, so it is in the case of the soil, and in order to get the soil in the right condition to grow the crops we must have those points in mind.

We can take them from three points of view; from purely the physical point of view, that is whether your soil is finely divided or whether it is clotted or lumpy, or what its condition is. Depending on the physical condition of the soil to a very great extent, but not entirely depends the amount of moisture which you can get into the soil.

I don't know if any of you have thought how the water actually exists in the soil. What is the form of water in the soil which is of value to the plant? Have you ever thought how it exists? Well it exists in different ways dependent upon the soil particles. For example, if you take a stone and dip it in water and lift it out again you will see that as you bring it out of the water it is covered with a film of water. Probably that film soon breaks across the top and tends to come down to the bottom, where you will get an accumulation of water which will gradually drop off.

That is the condition you try to get in the soil. As rain falls the soil particles get a film of water round them. But if more rain keeps on falling as we have had during the last fortnight, there is a greater film of water round those soil particles than they can hold and it will tend to drip off and sink in the soil. As it sinks in the soil it will take away anything that is soluble in the soil. What is not soluble of course cannot be washed away. If we have large lumps of earth we do not have sufficient surface exposed to hold the maximum quantity of water. If I were to ask which holds most water, sand or clay, you will immediately say clay. That is right, and why? If you had large particles and subject them to moisture falling on them they would

get a coating of water round them. If you broke the pieces into two you would get two additional surfaces to hold water, and as you break it up more and more you get a greater surface for holding water, and that is one of the objects in the thorough preparation of the soil that you have to try and bear in mind, to get this water holding capacity of the soil.

Of course we can get it in another way. We have heard a lot about green manuring plants, fillers, and so on, but there is one point that I don't think has been made, and that is that when you put organic matter into the soil in whatever form it is that organic matter is as it were cellular. It is full of little cells or holes, and like the illustration regarding the stone, so I might take another, and say that if you dip a sponge of the same size as the stone into the water and lift it out again, which would be dry first, the stone or the sponge? The stone would probably be dry in a very few minutes. The sponge would have moisture in the inside possibly for two or three days.

That is the position of organic matter or humus in the soil, and if, as Mr. Townsend suggested, we don't turn up the organic matter, the grass and stubble, but plough it in and increase the water holding capacity of the soil we are improving the physical condition of the soil. In the preparation of soil where it is only going to be done once in a long term of years there is no excuse for skimping the work, absolutely none. It is one job that must be done thoroughly. I was speaking to a young sugar planter coming back from Umbogintwini the other day and he said his father-in-law ploughed as many as four times but he did not agree with him. He thought his father-in?law wasted far too much time ploughing. What he wanted to do was to get the soil ripped up. Instead of getting 15 acres done get 30 or 45 acres done and get the crop in. That was the way to do it. Well it may be if everything else is favourable. He may come up smiling, but if things are not favourable, if a droughty season happens to come along, he will come up with a face longer than a fiddle, and so he deserves to. The thing must be done thoroughly, with no skimping.

With regard to the depth to plough, there is no hard and fast rule. It depends on the condition of the soil how deep you must plough. If you have an alluvial soil, a soil that is almost unlimited in depth and which is equally good if not somewhat better down below than at the top, then I say stick your plough in as deep as you can, because you are deepening the area in which the plants will live. You are making a larger feeding area, giving more storage of water or moisture and so on for them, but if your soil is shallow, if you can see the gradation from the darker coloured soil into the reddish or lighter coloured soil, then you ought not to go beyond the depth of that darker coloured soil in your ploughing.

The material down below has not been exposed to the weathering agencies, and has not been oxodised, and the material down below owing to its light colour has no organic matter there. Having very little humus there is very little micro-organism, and if you put the good stuff right down and bring the poor stuff up to the top you are simply diluting the soil. That is the point with regard to sub-soiling. If it is necessary to deepen the soil to increase the feeding area for the plant roots, moisture storage, and so on, then it ought to be done not by bringing the sub-soil to the surface but by stirring it up where it is, breaking it apart, loosening it, so that gradually the agencies which have brought the surface soil into its condition suitable for plant growth can act upon that other and bring it into a favourable condition also.

In this case thorough preparation is absolutely vital, and there is an old saying which I daresay you have heard before, and that is "tillage is manure." The thoroughness with which we till our soils must bring more and more plant food available in the soil. I was once asked what was the best manure to use. I don't suppose any of you will guess the reply. I said "the best manure you can use is elbow grease." If there was more elbow grease put into the preparation of the soil than there has been, better crops would result. If you try any substitute for elbow grease in that soil preparation you may be sure that you will meet with disappointment.

Thorough work means proper physical condition; it also means as favourable a chemical condition in the soil as you can get. One of the reasons why sub-soil should not be brought to the surface is because it is so lacking in the organisms which are necessary to create the plant food in the soil. Those are the things necessary in the preparation of the soil for the growing of a crop of cane. The watchword must be "absolute thoroughness and efficiency; no shortage of elbow grease." If you do that you can't go far wrong. (Loud applause).

Question No. 32.—"During the growth of a crop of cane what factors are likely to be limiting factors in the growth of cane on the Natal coast, and what should be done to overcome these as much as is practically possible?"

Reply by Mr. Fisher: That question follows somewhat on the previous one. The limiting factors which I put down as influencing the growth of cane on the Natal coast are:—The first I put down was moisture. That has been discussed by Mr. Ritchie, and those who spoke about green manuring, and I have already mentioned it in regard to the physical conditions of the soil. To overcome that you say if

there is not enough, irrigate. If, after one irrigation, it is not enough, irrigate again. That thorough preparation of the soil should be first, before there is going to be any irrigation. The conditions must be made as suitable as possible for the soil. That is the factor which is often the limiting factor. The second is probably a shortage of phosphates. We have already been told, at the first day of the Congress, how we can overcome that.

The next one I am not sure whether the planters will agree with me, and that is weeds. That is a very important lessening factor. Not being a cane expert, but simply travelling up and down through the country, wherever I see a lot of weeds growing I can only come to the conclusion that there is no room for the sugar cane! No two things can occupy the same space at the same time! If the weeds have got possession of the land then there is not going to be any sugar cane there. With regard to the remedy for that, I think everybody knows it. It is "elbow grease" again; there is nothing like it! (Laughter.)

Possibly the next factor is poor plant cane. That is extremely important. If we go as far as to do the thorough preparation of the soil, if we spend the time and money on that to secure moisture, and we buy our fertilisers and apply the elbow grease necessary to keep down weeds and so on, then we should be very foolish indeed if we did not plant the best cane that it is possible to get. (Hear, hear). The question of plant cane is coming on later.

Now another point I put down is Disease. If we could get as much moisture as is necessary, the requisite supply of phosphates, get rid of the weeds and get good plant cane free from disease, I think we should have got rid of most of the limiting factors with regard to the growth of cane on the Coast. I did not refer to any Bank balance or anything of that sort (laughter). (Remark: "that is a chronic disease").

Instead of the statement that the farmer gets his Bank to show him his balance, I would rather that the farmer considered that his balance is there on the farm where he can keep his eye on it, and it is there is his soil, the fertility of the soil is the farmer's bank, and whether the Zululand planters like us to tell them or not—I don't think Mr. Patrick objects anyway because I believe he said the same thing yesterday—what many a farmer at the present time reckons as profit is capital. I hope gentlemen that none of you are stealing "capital" and slipping it across into the profit and loss account and calling it "profit," because if you work on the double entry system you fill find your accounts won't balance in the end. (Loud applause).

Question No. 33—"What would be the likely outcome of planting bull shoots only for two or three times in succession?"

Mr. Fisher asked for some of the Planters to express their views on this subject first.

Capt. Greig: I have planted bull shoots but not as a field. I usually plant bull shoots to fill up any gaps that take place and I am careful in selecting them for that purpose. The reason I use them is because the eyes have come away rather more than the other canes and they come through quicker. They have been very successful, particularly at this time of the year, and particularly when a man happens to plant late, as unfortunately a number of us have to do. I find that bull shoots fill up "misses" very satisfactory, but I have never planted them as a field.

Mr. W. A. Campbell: Contrary to the old idea, our experience has been that they are just as good as from the tops, and in some places have given better results.

Mr. Fisher replied: I must make a confession here. When Mr. Eadie wrote to me in connection with this Conference he suggested that I should set a number of questions. I did so, but I did not know he was going to come across me to answer them all. I also thought that if he was going to come across me to answer them he would have given me an opportunity of preparing for them, but I found that quite a number of the questions were put down on the questionnaire and I was left in the position that I had no time to refresh my memory on the points which caused me to set those questions.

This question, the outcome of planting bull shoots, is really a botanical one and it comes in where you have a case of vegetative propagation. You must distinguish between vegetative propagation and the growth of seeds. You have totally different conditions. As a matter of fact there are numbers of things which are only propagated vegetatively. If you could imagine it, supposing you could cut off a hand and plant it and it could grow into another being. That hand would have the characteristics of the human being. If you take maize, one mealie growing here and another there. You will find that the seed is different from either parent; it is crossed and you have characteristics from both parents. But in vegetative propagation you keep the characteristics of the plant that you take the slip from or the cutting or the bud or whatever portion it is of the plant.

Take the case of the potato. If you plant an "Up-to-date" tuber you would be surprised if you got a "King Edward" plant growing from it. You would expect to get an "Up-to-date" and so you would. The characters remain very much the same. Now what is the difference between a bull shoot and an ordinary cane. I take it it is simply this, that a bull shoot is later in starting into growth. It gives you a somewhat thicker growth, a very rapid growth, but the characters, the real charac-

ters of that bull shoot are not altered from the original parent. At the time that you cut that it is probably lower in sucrose. It may be that it has very little sucrose, and it probably has very little, but if you were to give that shoot time to mature it would get just as much sucrose as any other cane. Therefore, from that point of view, they remain the same and it will have no effect on the resulting crop by planting a bull shoot.

If, however, there is no delay in starting into growth and there is sufficient nutriment in the plant behind them to force the growth along so that it immediately comes away there is nothing to fear. Because the bull shoot has a low percentage of sucrose there is no reason to fear the building up of a variety very low in that respect.

Question No. 34.—"Has the method of cutting the cane any effect upon the quantity of shoots produced in the ratoon crop, and if so, what is the best way to cut the canes?"

Mr. Townsend: I don't think there is any question at all in our minds as to this. I know many planters don't worry of course. I have seen fields with two or three and even four inches of cane standing on the ground, which is bound to result in deterioration in ratoons. The proper method of cutting cane as I have been taught since the early days is to cut the cane level with the ground. The result is that instead of the eyes coming out just above the ground they come from down below and you have a very healthy strong resulting ratoon, much better than if cut higher.

Mr. Dodds: Arising out of what Mr. Townsend says I would like to point out that in Louisiana I found it was strongly insisted upon that the cane should be cut as low as possible, and in fact they have a special implement for that purpose known as a "stubble shaver." That is a machine which has horizontal cutting discs, which travels over the ground after the cane has been cut, and cuts the ends practically flush with the ground. That was regarded as a very important point in their cultivation.

Capt. Greig: I don't think there is the slightest possible doubt on the matter. There is no question that there is only one way and that is to cut as low as possible. It ensures a very much greater crop as Mr. Townsend says.

Mr. Fisher in reply: When I set the question I wondered if there was any difference, whether there was a certain definite system of branching in the root stock of the cane which could be influenced. You cut it to mould the shape of the tree, and I wondered whether it was at all possible to cut cane in such a way that it might be possible to get two sticks as against only one if you cut in another.

I have since taken the trouble to look up the point and I find that the root stock is just like the ordinary cane. The branching effect of the root stock is more determined by the amount of space which there is for the branch or bud to grow, by the light which comes to it and so forth, and the amount of plant food that is available.

I quite agree with Mr. Townsend that if it is cut just about level with the ground so that the bud gets firmly established in the soil, that is the right practice.

Question No. 35.—"In the selection of plant cane, what special points should be considered?"

Capt. Greig: I have planted canes of various ages but I have always found that cane approximately fourteen months old gives the best results, and either plant or first ratoon plant cane for choice. First ratoons are very satisfactory indeed. I have found that it is better to cut one's cane in fairly short lengths and not allow it to remain in the furrow in one long stick. Eighteen inches to two feet appears to be the most satisfactory length.

Mr. W. A. Campbell: I consider that you should select your plant field and see that it is healthy and free of disease, and cut a long top and send the balance to the factory. By doing that you eliminate the root fungus. In the early days we never planted cane as a whole; the tops were always cut, and if we were pushed we cut what I term a very long top, but we always selected those tops from a plant field or vigorous first ratoon field, but the planting of whole canes has only come into existence within the last few years, due chiefly to the shortage of labour and the facilities one has for planting. I don't think there is any question about it, it is a wrong policy to plant cane whole, unless the particular field can be guaranteed free from root fungus. If it is not free you will propagate that root fungus in the new field. I think older men in the business, like Mr. Townsend, will bear me out in what I say.

Capt. Greig: I forgot to say that I always removed the basal joint two or three inches from the bottom to ensure that no fungus was taken in.

Mr. A. Townsend: My experience is that the proper cane to plant, of course, is plant cane if you have it. I also prefer to plant cane in February. If you plant cane in February or the end of January, by the time you come to cut the cane say about sixteen or eighteen months old you have only the one growth and it is far better cane for planting than cane which has been planted in the previous September or October. You will find your eyes are better budded and instead of an eight or ten feet growth you will only have about five feet. I find that late planted cane is a better cane for propagating than the earlier planted cane.

Mr. Campbell is quite right in saying that the old method was to use tops entirely. We never thought of planting the whole cane. I can tell you of my experience in 1886 when the Manager of the Blackburn Factory told me to see what cane we had for

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the mill. We went round the Estate and saw some very fine cane; then we came to a field which had been practically abandoned, where there were more weeds than cane. I said "what about that?" and he said "don't worry about that, we can use that for planting," and we did use that for planting too. That will give you an idea of what happened in the early days in some places. Later on of course the people realised their mistake and altered their methods.

I have experimented with cane that is mature plant cane eighteen months old, first ratoons of about the same age, and also fourth ratoons. Of course in taking the fourth ratoons I have picked out the bull shoots. I have planted the three of them under identical conditions. Curious to say the fourth ratoons at present show the best results. How far that will continue I cannot say. The second ratoons come next and the plant cane comes last in development. Of course whether that will continue it is difficult to say. But it is interesting to know that the germinating power of the first ratoon is quite equal if not superior to the younger cane. Perhaps Mr. Fisher can explain the reason for that. But there is no question that the selection of your seed canes is the keynote of the conduct of your farm.

Mr. Staniland: I would like to know whether altitude has anything to do with the vigour of the cane. As far as Maritzburg district is concerned you will get in six or seven months growth far better and stronger shoots of cane than ever you will get on the coast. The question has often come to me as to whether in the selection of plant cane it would not be well worth trying some of these up-country twelve months old shoots, which, as I have said, are far stronger and more vigorous than on the coast. Would the altitude have a tendency to make a stronger robust plant cane.

Mr. Schwikkard: The up-to-date maize farmer is always very keen to carry out germinating tests before planting his maize, and I think the question of germination is a factor which is equally important when applied to cane. My own experience bears out what various speakers have said with regard to the planting of tops. But it is not always possible to plant tops only. Failing tops the planter should then pay due consideration to the age of the cane he plants, paying further consideration to the other factors also.

It is recommended that the cane should not be more than twelve or fourteen months old, as by planting older cane it has been found that the buds have reached such a state of maturity that they commence to dry out and when planted they do not germinate, and that is the cause, or the chief cause of the misses that one finds in the fields.

Mr. Fisher in reply: I am very glad that this discussion has taken place with regard to the selection of plant cane. Important points have been made; the first of course is that the cane should be absolutely healthy. I think that is probably the most important because if a bull shoot does not make any difference to the succeeding crops I cannot see why a first ratoon or plant cane or second or fourth ratoon would make any difference except possibly it is in the rate at which the buds come away.

As regards the composition of the cane and so on there would be no difference probably, but what we want is uniformity. If by taking cane and planting the whole cane we get the buds coming away after the tops we are going to get an uneven standard. I can quite imagine that the buds near the base of the stem, which have been shut in more and have not been so near to the light and so on, will be later in coming to growth than the buds nearer the top. That will probably substantiate the planting only of tops or young cane. Now we have a similar sort of thing in planting potatoes. It is generally recognised that you get the best results from planting a tuber that is not quite mature. If that is the case—which is vegetative propagation—I think we could apply it probably correctly to the planting of cane. If we plant a cane that is not quite mature we will probably get more satisfactory results.

With regard to Mr. Staniland's question of bringing cane from higher altitudes, I think it is a suggestion which the Experiment Station ought to carry out. If it has an advantage I am sure that planters would like to get that sort of seed.

So far as I know we have no information on that point to show whether the change of locality results in increased vigour or not. There is one point we ought to bear in mind and that is that we ought not to take cane from an exceptionally good farm on to a poorer farm, otherwise that cane will tend to go back. If you are buying stock, the man who knows his business wont buy an animal from a better locality to bring it to a poorer locality. If he does the stock will go back on his hands. But if he reverses the procedure his stock goes on right away.

There is just another point I would like to suggest and that is this: though cane is vegetatively propagated we have variations within it. I am not sure whether it is not possible that some stools of cane grown under the same conditions with other cane right throughout a field, have not got a higher sucrose content than other stools and possibly a lower fibre content. I simply suggest that it is a line of work for the Director of your Experiment Station. If he can only increase, by selection, the percentage of sucrose—we won't go to the five per cent and seven per cent but simply to one per cent.

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even—the establishment of the Experiment Station will certainly not have been in vain. (hear, hear and applause).

At 12-55 p.m. the Conference adjourned for lunch.

THE CONFERENCE RESUMED AT 2-30 p.m.

Question No. 38.—"The cane loader, a form of portable crane, is used exclusively in Louisiana in cane harvesting and is a great labour saver. Could not this or a similar machine be adapted for use in Natal?"

Reply by Mr. Dodds: The cane loader is a portable crane usually drawn by mules and fitted with a 6 h.p. oil engine. Under favourable conditions two mules are sufficient but I have seen as many as five mules harnessed in heavy wet soil. The cane after being cut is laid across the rows in bundles by the cutters. The mechanical loader follows and picks up the bundle of cane from the row by means of a grab attached to a derrick, the grab filled with cane is then lifted and the cane transferred to a wagon which is drawn alongside the loader on the side opposite to the cane loading. The wagons are provided with chain slings which are laid in the empty wagons. The wagon when full is removed to the railway siding, or to the mill if only a short distance, and its place alongside the loader taken by an empty wagon.

The type of loader in use in Lousiana will handle if required 250 to 300 tons of cane per day, but the usual daily task is considerably less. The machine weighs about 2 tons and costs about 1,000 dollars in New Orleans, say £220 including freight to Durban. In Hawaii a heavier type of loader is in use. The Goodale pattern will load 720 tons per day and will operate on gradients up to 1 in 6, and has worked successfully in moderately wet lands even when making ruts 12 inches deep. The cane is placed in half inch wire slings laid on the ground, the slings are fitted with slip hooks and hold 2 tons of cane.

The loader has a 38 ft. adjustable boom and the cane is loaded into trucks on portable tracks 150 to 200 ft. apart. The difficulty of application of the Louisiana type of cane loader in Natal is that the cane rows are usually more or less flush with ground level, so that the grab as used in Louisiana is liable in this country to pick up a considerable quantity of earth and trash.

In Louisiana the method of cultivation is such that the cane is eventually growing in pronounced ridges and when cut the cane bundles are laid transversely across the ridges so that there is a clear space underneath for the grab to operate. On our alluvial flats this method of cultivation, originally devised to promote drainage, might prove satisfactory but on hillside soils the cane should rather be grown in concave rows to conserve soil moisture. Further details have been written for concerning the Goodale type of loader, which may prove more readily adaptable to our conditions.

Question No. 39.—"Is there at present a commercially successful cane harvester on the market?

Reply by Mr. Dodds: Many attempts have been made during the past fifty years to produce a successful mechanical cane harvester, but I believe it cannot be claimed that the problem, obviously a very difficult one, has yet been satisfactorily solved. At least one type of harvester, the Luce Harvester, which has had an enormous amount of study and work put into its development since 1904, will cut cane cheaply and well on favourable lands in Cuba and elsewhere, but the machine is very bulky and expensive (£5,000) and appears to be very complicated. Enquiries I made of the Luce Cane Harvester Corporation in New York elicited the fact that Natal is not a particularly promising field. The rows should be at least 6 feet apart for clean cutting and long rows are necessary for economical work, and the ground must be level and free from stumps and large stones.

Question No. 40.—"There being a belief that Uba cane loses its power of reproduction soon after the rainy season sets in, are any figures or data available which show the loss of growing power of "eyes" or diminution of virility in Uba cane used for planting, after the sucrose content of the cane begins falling on the commencement of the rainy season?"

Reply by Mr. Dodds: It is evident that the germinating power of the cane varies considerably in different localities and at different times of the year, but I believe this is due to the character of the soil and its temperature and moisture content rather than to the cane. Uba is in any case a very vigorous and prolific variety compared with others, and I would have believed it to be even more so during the warm rainy season rather than the reverse, as this question suggests. The heavier soils, especially the red clay type, lead to more failures in germination than the lighter soils and this is a matter which calls for investigation.

Recent experiments by the African Explosives and Industries Ltd., show that the method of application of fertilizer has considerable effect on germination. In Louisiana where the cane is mostly planted in wet and cold soil of heavy nature, excessive quantities of plant cane, up to 4 to 5 tons per acre, have to be used to get a satisfactory stand. It is found useful there to pack the soil closely about the plant cane by drawing a heavy roller over it, which assists germination.

Question No. 41.—"Is there any positive evidence of any progressive deterioration of Uba cane in Natal?"

Reply by Mr. Dodds: This is a question on which the opinions of the old established planters are required. Sugar cane, like any plant vegetatively pro-

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pagated i.e. by cuttings alone and not from seed. is believed to be liable to eventual degeneration and senile decay. Many botanists, however, do not agree with this, and in any case it is evident that the life of a vigorous cane variety may be very long in favourable circumstances.

Thus the old Otaheite cane, one of the richest in sugar ever known, was originally brought from Tahiti to Mauritius and Reunion about 1766 and is still in cultivation to a certain extent in different parts of the world under various names, e.g. Bourbon, Louzier, and especially in Hawaii under the name Lahaina. It is a cane very susceptible to disease and unfavourable conditions, and most of the disastrous epidemics in sugar have been due to over-dependence on this otherwise excellent cane, but notwithstanding its delicate character the variety has survived.

Similarly the indigenous Javan cane known as Cheribon probably first described in Rumpf's "Herbarium Amboinense" published about 1750, and which, according to Deerr, has probably produced more sugar than all varieties combined, is still the most widely grown variety in the world under the names of Crystalina in Cuba, Transparent in the British West Indies, and Rose Bamboo in several countries. The well known Louisiana Purple, and Gingham or Home Ribbon canes are dark-coloured and striped variations respectively and are also still flourishing after very many successive plantings from setts.

One would expect a vigorous type of cane like the Uba to have an even longer life than these varieties, but it might not prove to be so. At all events, as far as the evidence goes at present, there is nothing to show that it has appreciably degenerated during the comparatively short period it has been cultivated in this country, and given freedom from epidemics of disease or insect pests, it may be anticipated that Uba cane will continue to be a valuable cane for many years to come. Nevertheless no sugar industry ought to be dependent on one variety of cane, however satisfactory, and it is urgently to be desired that the necessary steps to introduce and acclimatise alternative varieties be taken as early as possible.

Question No. 42.—"Are heavy mules more economical than oxen on sugar lands?"

This question was covered by the paper given by Mr. Schwikkard.

Question No. 43.—"Is there a place for the dairy cow on the sugar farm?"

Reply by Mr. Fisher: This is where I ought to be at home. It always seems to me that a farm that has not a few cows on it and that has not some fowls on it is really no place to call a farm at all. It is unbalanced. You need these animals on the farm to balance the farming operations. We as menfolk don't realise sufficiently the difficulties of the womenfolk under semi-tropical conditions. Their work is inside work and it is work of a very tedious sort that we ourselves would very soon begin to kick against.

I think if we can do something to make it more interesting, to give an added interest especially in outside work, to the womenfolk on the place, to give them an interest in the running of the farm no matter if it is only a small section, I can assure you that it is a step in the right direction. You may be inclined to grouse occasionally at something in the house which you think is not just as it ought to be, but I can tell you that if your wife was to come out on the farm she would see a great amount to grouse about outside, more than you see inside (hear, hear). I am sorry that most of the sugar planters have not brought their wives along to this Conference. I want to enlist their sympathy in this regard because I feel sure that once we can get the "better half" of the farm going strong in that direction then the "poorer half" will have to follow the "better half." I feel sure that I could soon pursuade the "better half" as to the advisability of having two or three cows on the farm, so that there would be absolutely fresh milk in an unlimited supply—the most wholesome food that nature ever provided—an unlimited supply for the children who are growing up, we would be building a better race than we are doing probably at the present time (hear, hear).

There is also this point, that man is naturally very selfish—you can't get away from the fact. There is a very big streak of selfishness running through the whole lot of us, and children where they can call a native or Indian to do this and do that, don't get inculcated into them early enough that sense of responsibility which they ought to have towards the animals, and so on, on the farm (hear, hear). There can be no gainsaying the fact that the sooner a youngster is made to realise that young though he is there are certain responsibilities which devolve on him whereby he has to look after the animals, and that those pets are dependent on him; that he must see to their welfare, sacrifice himself in the first place for any pets he is looking after, I put it to you that he will be growing up not a worse man but a better man (hear, hear).

I believe there is room for two or three dairy cows on every farm, in order to provide that wholesome article of diet and in order to give an added interest on the farm, because children and their elders will generally be bound to take a much greater interest in the animals than simply in crops. I submit that where the planter has not two or three cows he ought to consider it very seriously. They won't get Streak disease. There is no reason why they should get tick fever, if properly bought there is no reason why they should get gallsickness or redwater.

I am sure they would be a source of interest right through the year.

Question No. 44.—"What are the advantages of poultry on a sugar farm, and what size of laying flock would be considered economical?"

Reply by Mr. Fisher: Most people we have something that tends to balance up the unevenness of the sugar farm. When you come to poultry you get an article of food that tends to balance the year as regards employment. You get the wholesome food, eggs and if the farmer's wife does not come along you can visit the poultry yard and you do not go back to the planting field. It may seem to some of you to some people to think that it is coming down as a mere child's play but I submit again that there may be method in connection with poultry a considerable interest that will be maintained right throughout the year.

We have a poultry conference at Cedara every year, and I may announce to you that we are between 3,000 and four hundred people attending that conference every year and the greatest trouble is to get them. On the Coast lands you have almost ideal conditions for running a small flock of poultry. You have little rain practically, for months, and conditions almost ideal all the year round, plenty of insect life, and so on.

If you are keeping a small flock of poultry there is no question about having one's eggs for breakfast. There is nearly always a surplus, especially if the fowls are well looked after, which is available for the market. I am sure the children on the farm would take a keen interest in them if they were given an idea how to look after them, and if you tell them they can have the themselves, and point they make on the fowls, you will find that you are starting to treat them as a good business to learn right from the very beginning. That is one of the reasons I think that the farmer generally lacks and that is the business sense. He has not got a very great sense of business sense as a rule. If you can get a flock of twenty-five or fifty laying hens on every sugar farm I think you will get results it will be to your benefit, and if you don't find the worrying about the smaller things you have time to do the children and let them worry about them, and you will be doing an extra good turn, you will get a good mark for it. (Laughter).

Mr. Fisher: Mr. Chairman, I would like to add a word to what Mr. Fisher has said. Mr. Fisher has recommended sugar planters to get cows. I like to recommend them to get cows and they worry plenty of milk also. I cannot what is required for ox. They will then have the finest food they can give to calves that has anything wrong with the breeds. They will have the finest food for children, and once they get in the habit of having it will be the finest thing that can get.

Question No. 45.—"What is required to balance cane tops as a food for oxen or mules?"

Reply by Mr. Fisher: Cane tops are very largely carbonaceous. There is a certain amount of wear and tear through the body which must be made good, and where hard work is to be done it seems that there has to be a fair amount of available protein also if the animal is going to keep fit. What is required to balance cane tops is some protein rich food. Velvet beans, cow pea hay, velvet beans and hay, or something in the way of a concentrate, such as ground nut cake or cotton seed meal or cake which supplies a large amount of protein food which will balance the rather herbaceous portion supplied by the cane tops.

I know that in many cases oxen and possibly mules are fed altogether on cane tops. We are told that mealie meal is not a suitable food for Natives. How would you like mealie meal porridge for breakfast, mealie meal porridge a little bit burnt for lunch, mealie meal porridge a little extra thick or thin for dinner, how long would you work on it, and how soon would you go on strike. If so, why keep your animals on a similar ration which you would not tolerate for one day for yourselves. (Applause).

Question No. 46.—"What new varieties are the most promising for trial in Natal for (1) hillside fields, (2) alluvial flats?"

Reply by Mr. Dobbs: "The question of new sugar cane varieties for Natal is a very wide subject on which comparatively little work has been done. It is evident that for the ordinary unirrigated hillside plantation, the which in course of time has supplanted all other varieties, is a variety specially adapted to local conditions, and it is not easy to suggest varieties likely to prove superior under these conditions. This is fortunately because in Mauritius, where on the sugar industry of Natal would probably have been practically destroyed during the last few years, it is probably relevant to remark, however, that to say there is reason to believe that Uba is less susceptible to Gumming disease than to most susceptible varieties, and it is also less subject to insects and other animal pests.

The one type of disease to which it has been found susceptible, certain forms of smut, does not appear to have proved a serious menace to Uba in this country. The cane is also extraordinarily resistant to drought and frost and to general neglect in cultivation, and possesses great recovering powers.

The only other important varieties which show the property of immunity to Gumming disease are a few other varieties of similar Indian origin such as Kassoer, Striped Crystal, Crystal, and Kassoer, but recently the Field varieties 2714 and 2727, Carnaby hybrids of the above appear to have inherited the disease immunity such as the hybrids of Uba developed in Cuba, and the Kassoer seedlings from

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United States and some of the latter are probably worthy of trial in this country. Some seedling canes from Cuba that were recently imported by Mr. R. C. Wade of Ifafa, and were detained by the Department of Agriculture and eventually handed over to the Sugar Association by mutual agreement, are now being cultivated in a temporary quarantine greenhouse at the Government Herbarium, Durban.

A description of these canes has never been received but they are believed to be specimens of the variety C.H. 64 (21) a hybrid of Uba, and of D74, the very rapidly maturing variety of high sucrose and low fibre content that has proved so successful in Louisiana. This hybrid, the so-called Super Uba was originated at the Cuban Government Experiment Station near Havana a few years ago and has so far proved very promising. The sucrose content is satisfactory, varying from 10 to 14 per cent, with a very low fibre, 8.6 per cent; there is also very little formation of wax. The cane grows very rapidly and stools profusely, and so far has proved uninfected by Mosaic disease; it is believed to possess the immunity to Mosaic of the Uba parent.

None of the varieties known to be immune to Mosaic appear to be of the thick, sweet type of cane, such as is required for alluvial soils in this country.

One of the susceptible varieties suitable for hillside plantations D.1135 may prove to be a useful substitute for Uba.

D.1135 originated in British Guiana and has given excellent results especially in Queensland and Hawaii. It is resistant to cold and also to drought to some extent, but flourishes best in wet, or irrigated hillside soils. It is an excellent ratooner and gives heavy yields of cane but is not particularly rich in sucrose. It has given good results at Mount Edgecombe.

Some of the P.O.J. varieties are also highly resistant to frost and drought, notably Nos. 36 and 213 and to a lesser extent 234. They are of Javan origin being hybrids of the Indian cane known as Chunni with indigenous Javan (Cheribon) varieties.

P.O.J.36 is a very rapid germinating and growing plant, and ratoons well. It is high in fibre and difficult to crush; it deteriorates rapidly after cutting and must be milled within two or three days at most.

P.O.J.213 has proved of equal value to the above in the elevated sugar growing province of Tucuman in Argentina. It does not germinate or shoot quite so rapidly as No. 36, but makes very rapid growth when once established. It yields and ratoons equally well and is less fibrous.

P.O.J.234 is a phenomenally rapid germinating and maturing cane, having acquired high sucrose and purity in Tucuman after seven months growth. The sucrose content is high but it is not a very heavy cropper, and its ratooning properties are somewhat inferior. The fibre content is high and it deteriorates after cutting even more rapidly than 36 and 213, and it is not quite so highly resistant to frost and drought as those varieties. At the present time it is being extensively planted for [illegible] ing in Louisiana and sold at 110 dollars [illegible] a ton.

It is interesting to note that these three P.O.J. varieties appeared to be immune, or at least [illegible] highly resistant to Streak disease, when grown [illegible] Natal.

Of the Indian canes, some of the Coimbatore seedlings notably C.213 which established a record value of 19 per cent sucrose in cane in India last year, also possibly some of the Assam Red type grown in the Punjab, should be tried in this country.

For alluvial soils the choice of varieties is exceedingly great and it is possible to mention only a few. Badilla or M.6.15 a cane of New Guinea origin has given excellent results in Queensland and in Hawaii and gives phenomenal yields of cane and sucrose under favourable conditions. Ginger, which is described as a hybrid of Singapore Striped Cheribon, and Goru (S.C.24), has also given excellent results in Queensland during the last year or two.

Of the older established varieties White Cheribon, also known as Crystalina, Rose Bamboo, White Transparent, Green Natal, etc., are worthy of further trial, also White Tanna (Yellow Caledonia), Santa Cruz 12 and many others. All of these, however, are susceptible to Mosaic disease, and it would be useless to import them under present conditions so long as any susceptible varieties, not under effective quarantine, are permitted to exist in this country."

Question No. 47. "Is it a fact that the cultivation of Uba cane is rapidly extending in many countries including those that have never grown it before. What are the reasons for the extension?"

Reply by Mr. Dodds: "It is well said that a prophet is not without honour save in his own country, and Uba cane appears to be far more highly praised in countries which have only recently realised its possibilities than in Natal where it has been the mainstay of the sugar industry for many years.

In many sugar growing countries, e.g. Porto Rico, Cuba and Jamaica, Uba cane has been introduced in recent years where the standard varieties were badly affected by Mosaic disease. Not only has Uba cane established its immunity to Mosaic disease everywhere, but it has created agreeable surprise by its productivity especially in poor dry soils. Although it has lower sucrose and higher fibre content than the thick canes, the yield of cane and of sucrose per acre in nearly every case is greater.

No special difficulty or loss is met with at any stage of manufacture, the difficulty in [illegible]

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tion experienced in Natal being probably due to the abnormal formation of wax on the cane during the long cool dry winter season, which has no counterpart in the American tropics."

Question No. 48.—"By what percentage will the humus content of such soils that is, old cane lands of a sandy nature that have become deficient in humus, be increased by the growing and ploughing in of a moderate unfertilised crop of mixed cow peas under ordinary conditions?"

Reply by Mr. Dodds: A good crop of say nine tons per acre of cow peas will contain about 16 per cent, that is, one and a half tons of dry organic matter.

The average weight of soil is about 1,500 tons per acre to a depth of 12 inches, consequently a crop of cow peas such as the above turned in to a depth of one foot would only increase the organic matter in the soil by 0.1 per cent. As mentioned elsewhere the benefit of a green manure crop cannot be determined in this way, the principal benefits probably being the improvement in texture and physical properties of the soil and changes in the bacterial flora.

Question No. 49.—"What percentage of increase in humus can be expected from the application of three tons of average moderately dry kraal manure per acre?"

Reply by Mr. Dodds: The same considerations apply here, the actual increase in humus content of the soil brought about by the application of three tons per acre of kraal manure being negligible, and the cause of the undoubted improvement brought about by the application of organic manures must be sought in other directions. The composition and especially the moisture content of air dried kraal manure varies so enormously with general conditions that it is impossible to give any reliable average figure. But assuming air-dried kraal manure to contain one-half of its own weight of dry organic matter three tons would contribute 1½ tons of humus to the soil which would increase the quantity per acre to a depth of one foot by 0.1 per cent.

Question No. 50.—"What percentage of increase in humus content can be expected in the trashing and ploughing in of the trash of a field of say 25 tons per acre cane as opposed to the burning and loss of the same trash?"

Reply by Mr. Dodds: Experiments published by Dymond at the 1923 Sugar Congress showed that a crop of 25 tons per acre of sugar cane contained 7070 lbs of trash and 22,670 lbs of green tops equivalent to 526 tons of humus per acre from the trash and 267 lbs per acre from the tops which is equivalent to 0.017 per cent in the soil to a depth of one foot from the trash, and 0.008 per cent from the tops, or 0.025 per cent in all. The quantity of trash and its composition are very variable factors, however, and the quantity of organic matter involved may be very much greater than this. Thus in Queensland it was found that green leaves of Uba cane from Natal contained 25 per cent of dry organic matter in place of the 9.2 per cent in the dry trash corresponding to 7.4 in the trash as cut, found in the above experiments.

Question No. 51.—"Would it be unreasonable to expect an increase of two per cent of humus in a soil containing already 1.7 per cent of humus, making a total of 3.7 per cent after the application of five tons of air dry filter press cake per acre?"

Reply by Mr. Dodds: Yes. The increase in humus content of a soil from the application of five tons of air-dry filter press cake would not be anything like two per cent but only one-tenth of this increase. According to Dymond dry filter press cake in Natal contains 63 per cent of organic matter equivalent to three tons of humus from an application of 5 tons of press cake per acre. This corresponds to 0.2 per cent on 1,500 tons the approximate weight of one acre of soil one foot in depth, and an increase in total humus of the soil in question from 1.7 to 1.9 per cent.

QUESTIONS RELATING TO WHITE LABOUR.

Question No. 52.—"Can you give the Congress any information regarding the economic results of the use of White Labour in agricultural industry generally having in view the alternative use of Native labour."

Question No. 53.—"Have you good reasons to submit in favour of sugar planters employing white labour and to what kinds of work and type of labour do these reasons apply."

Mr. H. Fowler, Chief Factories Inspector, combined his replies to these two questions, as follows:

"I have come down here to represent the Department of Labour and in doing so I wish to express on behalf of the Department the thanks of the Department to the Congress in allowing us to be represented here, and at the same time I have to offer an apology because I am not the best representative that could have been sent. The Secretary for Labour would have liked to have come, and he has asked me to apologise that his duties in Cape Town have prevented him from coming. It was also the intention to send down the Chief Welfare Officer who is far more au fait with the work than I am. The Minister of Labour has indicated the policy of the Department on more than one occasion more especially last year at the Agricultural Congress,

where he met a committee of sugar planters I believe.

It is a question which is a very difficult one and one which cannot in any way be rushed. On Wednesday last I saw Col. Creswell in Johannesburg and he wished me to stress the question that this is one of great difficulty and therefore what may appear to be delays on the part of the Department are really caused from the very carefulness with which every scheme has to be investigated. He wished me to say that of course he would welcome any reasonable scheme that can be brought before him, and he is only too pleased to co-operate in every possible way, and he asks for the co-operation in every possible way of all agriculturists.

Up to the present the experience of this Department in regard to rural employment is somewhat meagre. At first men were sent out for employment on farms without any process of training or testing. Machinery, except so far as the Forestry scheme is concerned, did not exist for these purposes.

The Tenant-farmer scheme has, however, altered this state of affairs and it is expected that very valuable information will be collected as to the capacity of men at present on relief works of becoming independent farmers. It is, of course, too early to express any definite opinion as to the success of the scheme—some 400 tenant-farmers have been placed up to the present and some have been working for the best part of a year. There are indications that a very large percentage will make good.

Bulletins as to the scope and progress of the scheme are published from time to time by the Department and will be one of the features of the Labour Gazette which is about to be published as part of the Journal of Industries. The first number will appear in April.

The bulk of the tenant-farmers are recruited from forestry works. Records in regard to capacity for work, character and suitability for the life of a farmer are kept and careful selections are made. In addition to these schemes a training farm is being established in the Transvaal at Hartebeestfontein and it is hoped to provide for some 400 to 500 families. Men will be recruited for the farm from existing relief works. Two grades of stations are being provided for. The entry to the farm will be from relief works to a "B" station. Here a fixed wage will be paid to all employees, suitable housing will be provided with medical facilities which will be under the control of the Department. Native labour will be excluded entirely and liquor will be rigorously excluded.

From this "B" station the best workers will be sent on to an "A" station where the facilities will be better and the rate of pay granted according to the capacity and merit of the worker. Provision will have to be made for a "C" class of man, especially the crippled, aged and infirm men incapable of performing a day's work. For this class the best provision would appear to be the establishment of Rural Alms Villages quite apart from the training farms.

It is hoped that it will be possible to pass approximately 100 men per annum for "A" stations to the tenant-farmer scheme, to probationary Land Settlement schemes, and to farmers as overseers, etc. Steps are being taken to establish further training farms in the other Provinces. It is hoped by this scheme that in course of time the Department will be able to provide trained and tested men for the agricultural industry. The success of the scheme, of course, depends considerably on the sympathetic co-operation of agriculturists. Transvaal farmers have been pleasantly surprised on the whole with the type of men sent them as tenant-farmers, consequently the demand for tenant-farmers is growing to such an extent that it is under contemplation that in addition to the seven Welfare Officers engaged on the obtaining of applications in the Transvaal more will perhaps have to be appointed.

The advantages of procuring a reliable man on the farm can well be left to the imagination of farmers. Selection of tenant-farmers is carried out very carefully and tenant-farmers selected from the various forestries are medically fit and used to hard work and will do well in a supervising capacity on sugar estates.

The average loan of £90 each for 400 tenant-farmers has in all cases been sufficient to provide for building material, trek gear, livestock and implements, and it is suggested that tenant-farmers in Natal be used in the capacity of foremen or overseers in return for which the owner allots to each say 12 acres of established cane and 12 acres land on which cane can be established. This arrangement would, together with the subsidy of nine months full and 6 months half, secure the tenant-farmer a living during the first two years; thereafter he would earn more, and, if thrifty, make good.

I feel convinced that should planters once have the actual experience with selected tenant-farmers that the demand in Natal for tenant-farmers would be equal to that in the Transvaal.

Mr. Staniland: A hundred men seems a small number to be transferred from "B" scheme to "A" scheme in a year. I should have thought the number would be a great deal more.

Mr. Fowler: I should have explained that the idea is this: there is only one scheme for the Transvaal. We hope to establish similar schemes in each Province, but the one in the Transvaal has been put on a very conservative basis. We hope to do better later on. We hope to employ twelve hundred men at one time, but owing to certain circumstances at

present we have put that on a conservative basis. The figures given are only for the Transvaal.

Mr. G. H. Hulett: Last year I understand that the Government were prepared, in case of a planter wanting an overseer, to allow the planter £100 or £150 to erect a building on loan, repayable over a certain number of years, and that they would also allow so much a month up to £5 a month, so that a planter might employ this man without an outlay of considerable money to commence with. That scheme rather commended itself to me, and I spoke to several planters in my neighbourhood and elsewhere, and nearly all of them were prepared to take on men.

I communicated with the Department on the subject but I was told the matter was under further consideration, and I should get a reply later on. We have not had that reply. I do not know whether that scheme has been withdrawn, and I would like to know if it is still available. If an application is put in to-day will the Department give £150 and £5 a month for a certain period, and after that the man would have to receive a wage that the Department agrees is fair.

Mr. Fowler: The tenant-farmer scheme still holds good and the terms are up to £150 advance and for the first nine months 45/- for parents and 12/6 for each child, and for the following six months half of that, not exceeding a maximum of £5 7s. 6d. a month.

Mr. Hulett: These planters were not prepared to give a share in the estates at all. The men must work as overseers and take the place of Indian and Native overseers. A lot of these young men are just starting in life and cannot spare the money. If they can get assistance in erecting a man's house they would prefer employing a white man until thoroughly established. Later on it is fully intended that the men should get a living wage.

Mr. Fowler: Schemes of this nature have been put up to the Department and are receiving very careful consideration. But there are difficulties of administration. If you have tenant-farmers they have to be kept under very careful supervision and we find that if they are scattered about in ones and twos in different parts of the country the administrative charges to keep them under proper supervision mounts up to such an extent that we have to make a survey of the country and to work on a properly organised system and take a particular district and place twenty to thirty men in that district. By doing that the administrative charges are less. At present the Department is trying to work it on a system of placing them in groups. With regard to the employment of individuals I don't remember whether we have any definite scheme except that as I have said we make the suggestion to planters that we will in the course of time be able to give them selected men to take the place of Indians who, I understand sometimes draw wages up to £15 a month. Is there any reason therefore why that money should not be paid to a white man? After all the Sugar Industry owes something to the country; it gets a certain amount of protection and in return it should be possible to take white overseers and pay them the same wage as other races get.

Chairman: Are these men available at the present time.

Mr. Fowler: There are a certain number available.

Mr. Townsend: The difficulty in this question is that the majority of the men would not be able to speak the Native language, they would be entirely ignorant of the Indian language, and those men employed as overseers would be pretty hopeless for a time. A scheme of that sort seems to be entirely in the air. The scheme the industry would like to try and work is: is it not possible for the Government to form gangs of men to take the place of the cutters. Any scheme for the placing of men who are entirely ignorant of the local conditions and who do not understand the languages of the Natives and Indians, would be hopeless I am afraid.

Mr. Staniland: That is quite true. That is a weakness but that does not alter the great question that is before us—the absorption of white labour. If we are determined, if we have any zeal, any respect, any enthusism, I think we ought to make a great effort in regard to the placing of white labour. What can we do? Are we going to sit down idly? It resolves into this, that each planter individually has to try and do what he can to absorb white labour. Presently the Government will probably have a matured scheme to put before us.

In the meantime what we have listened to brings nothing mature before us; it leaves us in the same position we were in six months ago when we gave the assurance that we would try and absorb as much white labour as we could. That assurance stands to-day and I would like it to go back to the Minister, that we as sugar planters will try and fall in with any matured scheme that the Government will bring before us. After all we are all labourers.

Mr. Fowler: I would like to say that we don't hold that we have any hard and fast scheme. After all the Government can only do a part. One of the great difficulties has been that there has been no classification of the unemployed. People have been pitch-forked into relief works all over the country without any system of trying to find out if they are efficient or not. We are endeavouring to classify, train and list them, and come forward and say we have a supply of labour which we can guarantee, and we ask you on your part to do your share and say you will find openings for them. That is the position. (Applause).

QUESTIONS RELATING TO NATIVE LABOUR CONTRACTS.

Question No. 54.—"Can you suggest any means for Natal employers escaping from the dilemma in which they are placed by having their labour attested under the Native Labour Regulations Act No. 15 of 1911, while the labour must be controlled under the Natal Master and Servants Law (Natives) 1894, and between these two laws there are alleged by the authorities to be such differences as to render contracts under the former Act invalid in Natal."

Reply by Mr. Barrett: I have to begin at the end of the question and deal with the suggestion that Act 15 of 1911 (the Labour Regulations Act) is invalid in Natal. That is not exact. It is perfectly valid in Natal, but it does not apply to the sugar planter nor does it apply to the wattle or tea planter. Those industries are cognate with the farming industry and the Act does not apply to them. The farming industry was cut away from the Native Labour Regulations Act, and tea, sugar, and wattles were cut away with it.

The Act is valid and in certain respects it is operative. It is fully operative in regard to the coal mines and partially operative even in regard to your own industries. The initial contract of service which recruited labour has to enter into before it leaves its district of origin must be in accordance with Act 15 of 1911. The reason is that that Act is an Act primarily for regulating Labour Agents and recruited labour. Your labour, in so far as it is recruited labour, at the beginning comes under Act 15 of 1911. Then when the boys are brought here to work we begin to experience the great difficulty of confusion between the principles of Act 15 of 1911 and the Master and Servants Act of Natal. Act 15 of course is 30 years later than the Natal Act; it is an Act which was drafted mainly to meet the conditions of the Witwatersrand, but broadly it is applicable to recruited labour under industrial conditions anywhere.

Therefore it is undoubtedly the Act which you should endeavour to make applicable to your own conditions. It is the only Act which aims at controlling industrial Native labour. Your own Master and Servants Act is a domestic Act. It is founded on an old Cape Act and it was based on the idea of the sanctity of the contract between one servant and one master, and throughout its construction it really depends on the idea of a contract between one man and another man. The other Act was constructed specially to deal with the vast number of imported labourers to be controlled on the Witwatersrand, and it was between one employer and thousands of employees. I ask you which is likely to be the law which will help you in connection with the industrialised labour in the Sugar Industry. You have no time to enter into individual contracts with your Natives, and you want a piece of legislation which was specially designed to meet industrial conditions. That I think is the real answer to the whole question.

I can suggest various dodges by which you can make a contract which will be valid for the purpose of the Master and Servants Act in Natal and of Act 15 of 1911. But gentlemen they don't get to the root of the matter at all, and I don't want to be suggesting dodges which point to being pretty near evasions of the Law. We want to get at the root of the matter and arrive at a solution of the matter which will apply modern machinery to the industrial conditions in sugar planting. The Act already applies to a sugar mill and wattle bark factory. It would also apply to a tea factory I think. It applies to mines and works as things stand, and does not apply to agriculture. At present you are classified into "agriculture."

At a recent congress there was an expression of opinion in favour of so modifying Act 15 of 1911 to become applicable and during the past twelve months amendments of a certain crucial definition in the Act have been drafted which, if adopted, would enable the Minister to apply the Act to your industry. The Native labourer for the purpose of the Act is a Native employed on Mines and Works or recruited under the Act. "Mines" is a pretty clear definition. "Works" is a much more technical definition but they do not embrace your industry. An amended definition has been devised which enables the Minister having regard to the special nature of any work and to the members employed thereon, to proclaim the Act so as to embrace that class of labour within the definition of a "Native Labourer" for the purposes of the Act. If only that were put through you would be in a position to have a modern piece of legislative machinery applied to your industry. At present you are between the devil and the deep blue sea so to speak.

It is not surprising that there should be a great deal of difficulty created in the minds of Magistrates to say how far the contract falls under the one Act and how far under the other. As I have said, there are means by which we could make a contract which would be valid under both Acts but they are of a detailed nature which I should prefer to discuss with a committee rather than the whole Congress. I am strongly of opinion and my Department is of opinion that the solution is to get Act 15 applied to your industry for the reason that it employs large numbers of Natives imported into your industry.

Chairman: May I ask what is the difficulty the Government find in this matter?

Questions Relating to Native Labour Contracts.—Contd.

Mr. Barrett: I cannot say for certain. I know a draft Amending Act has been prepared by the Department but I have also heard that that Bill is not likely to go through this Session possibly because of the very conservative statement on our Native policy published lately. But this is not a question of Native policy; it is a small localised industrial question, and I should think it is entirely in the interests of this industry to press for a solution of this problem. It is not a question of politics; it is a question of control of Native labour.

Might I make this point: where an industry comes to the Government and says it wants additional facilities in regard to the execution of the special forms of contract, it is only fair to the industry to concede to the Government to look at both sides of the contract, not only that of the industry but to give it fair facilities for watching over the interests of the Native. You are well able to look after yourselves, the Native is not. The Native Affairs Department is there for the purpose of watching the interests of the Native among other things. Act 15 enables us to watch the contract from the Native side as well and to see fair play on both sides.

Mr. Staniland: May I ask if this amending Act is purely an industrial portion of the Act or will it apply purely to agriculture. If the two are mixed I am afraid that the agriculturists are going to suffer.

Mr. Barrett: I think it is one on the border line. There is no proposal to make Act 15 apply to the ordinary small farmer. The idea is for the Minister to be empowered by that Bill to consider the nature of an industry, the numbers employed, and decide whether or not the circumstances entitle him to proclaim that the labourers in that industry fall within the Act.

Mr. G. H. Hulett: I think the object we desire could be obtained by an amendment of the Native Master and Servants Act of Natal, and make that Act only applicable to Natal instead of bringing the 1911 Act into operation here. It only applies here as regards the engagement. As soon as a Native comes here to work he comes under the Native Master and Servants Act and is dealt with under that Act. The provision that we want made applicable to us is to secure our labour for a definite term; would it not therefore be better to make our Act applicable? If we did that would it not be easier to get it through Parliament?

Mr. Barrett: I think the Master and Servants Act, in order to better the Sugar Industry, would have to be amended right throughout. It is domestic; it is a contract between one man and another, and it covers the domestic servant and the ordinary farmer and his half dozen boys, and in its very conception it does not deal with industrialised conditions. It would have to be amended entirely.

It would have to be a new piece of legislation and be criticised by Parliament as such. Surely you have a better chance of getting a piece of legislation through Parliament under the very simple guise of the amendment of a definition? You amend the definition and give the Minister discretionary power to declare certain classes of labourers to be Native labourers for the purposes of that Act.

The other is entirely antiquated machinery. The drafting of that Master and Servants Act is so extraordinarily different that you have men who have far larger legal experience that I have, disagreeing as to the meaning of the very vital fundamental clauses of it. That in itself seems to me to be enough to give you full reason to fight shy of the old Act.

Question No. 55.—"What is you opinion about the practice of putting Native labourers on task work, having in view a statement by a Zululand Magistrate that the introduction of task work provision on a Native Contract renders it invalid under the Master and Servants Law?"

Mr. Barrett: That question enables one to knock another nail in the coffin of the Master and Servants Act. That does mainly deal with the contract in terms of time and not in terms of work done. There is only one reference in the Act to task work and it seems to contemplate the employment of a Native at one task, at the end of which he would be free to go off. For the rest, the specimen forms appended to the Act, and the language of the Act, are in terms of time.

I do not think that the Act is irreconcilable with the idea of taskwork, but it certainly makes very little provision for it, and you have to stretch it this way in order to try and make it applicable to a task system. On the merits of task work I don't think the Native Affairs Department has anything to say. My personal opinion is that a moderate task which will enable a Native to knock off fairly early and give him a little rest in the course of the day is better than a contract to work from sunrise to sunset (hear, hear).

I don't think a man can do his physical utmost for twelve hours on end. I should feel that it was a more reasonable thing if some means could be devised to standardise a task and I should expect you to get better results and the Native will be better satisfied with some form in which he gets more money for a good day's work than he does for a bad day's work.

Mr. Staniland: It has been construed as illegal for us to give our Natives task work. Is that right?

Mr. Barrett: That will depend on the written contract you have entered into with your Natives at the beginning. If you have entered into one which is constructed in terms of time then you have no

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power to change that. But apart from that there is nothing illegal in task work.

Mr. Hulett: Would the Department bear that point in view in any future legislation; the contract made should definitely authorise task work

Mr. Barrett: Act 15 of 1911 quite clearly recognises the principle of task work.

Question No. 56.—"In view of objections that have been taken in Natal to the ticket system for payment of labourers what are the grounds for these objections?"

Mr. Barrett: I think that question is really answered. I understand that certain Magistrates have held that on the contract which has been before the Court at that particular time the master was not free to say that a man's month consisted of 30 complete tickets, because his contract specified a month. A month is specially defined in your Master and Servants Act as "thirty days," and with the introduction of a ticket showing how many completed tasks have been performed one gets back to a change of basis. It is an indication of so much work done instead of so much time wasted.

I think that in the contract before the Court when that particular question was considered it was almost certain that the term "month" had been used. I know that in most of the contracts the term "month" has been used. If we are up to dodges we must avoid the use of the word "month." You should have a contract for so many days. But that is not going to solve all the difficulties. It will only be a means of tackling one of the particular difficulties. If you use the term "shift" in a contract undoubtedly any lawyer will tell you you must define what you mean by a shift. That is at the foundation of your contract. I believe you have the utmost difficulty in defining what you mean by a shift. If a shift was defined in the contract then I don't think there would be any difficulty about the enforcement of a contract in which the term "shift" was employed. But certainly if it is left to the employer to decide what the shift is to be then it tears the contract from the beginning.

Question No. 57.—"Apart from its economic significance what are the advantages of the "Sunrise to Sunset" practice usually adopted in employing Native labour up country in Natal, and is there any legal barrier to following in suitable cases the method of the Factory Act by fixing the working hours at so many per week, dividing that into hours per day and requiring the labourer to contract for so many "shifts" of such days?"

Mr. Barrett: I would like to point out on behalf of the Department the unfairness of varying a shift. The ordinary is for an employer to work his labour for a certain time, measure up what has been done, and divide it by the number of days and workmen and say so much is a day's work. He then fixes that as his task for the time. If he has one of these concluded contracts he must obtain the consent of his Natives before he can make that change, but provided there is no legal difficulty about it, the result will be that whereas it previously took him from sunrise to sunset per boy per day to do that work he will find a large number of his boys knocking off at 2 o'clock. The rapacious employer, finding that, will put up the task, and sometimes within my knowledge it has been put up more than once. That is absolutely an unfair thing. The boy is entitled to the extra energy he has put into the work. This driving of a boy from sunrise to sunset is not right. Task work seems to admit of a certain amount of leisure and reward for extra labour he may put in. He is entitled to the benefit of that and he should not have his shift moved up. He has given you his money's worth already (hear, hear).

QUESTIONS RELATING TO NATIVE LABOUR. MALARIAL CONTROL, ETC.

Question No. 58.—"Allowing for the limited capital usually at the disposal of settlers, the imperfect acquaintance with the conditions of the Zululand Coast Belt, and having particular regard to the presence of malaria, what is the most practicable method of dealing with the problem of:—

(a) Protection from mosquitoes in European houses and Native quarters.

(b) Providing for the prevention and cure of malarial fever."

Dr. Park Ross in reply: I have brought here to show you a model of a barrack which has been constructed to my designs. The object of getting out this design is twofold. In the first place there are certain conditions of the labour market which make it desirable that we should, I think, depart from our present system of constructing barracks, and get on to something which will be suitable and readily adapted to any change in the type of Native labour you may employ. Such is very important when you have to consider building in permanent materials such as brick, concrete and so on. You want a building which will be readily adaptable to any change in the labour.

Secondly, in the malarious areas in the north the present type of barracks or the multiplicity of types of barracks are not exactly suited, except in very

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few instances, to the labour which is housed in them. Further, in some of the districts, especially north of the Umfolosi, it is a very difficult thing to get building material with which to build suitable barracks; and lastly in regard to the cotton industry especially, we are likely to be faced with very great influxes of labour while the picking is going on, more than occurs in the sugar industry. In the past it has been the policy of my Department to set before you certain housing regulations, and not to interfere in any way with the liberty of the subject as long as he built to these housing regulations. That is to say we allow a man to build any building he likes as long as he observes the spirit of the regulations and as long as the Natives get a decent deal.

I am at one with that view and have endeavoured to carry it out for the last few years. (Hear, hear). But in response to the requests of a large number of men and in view of the fact that I have an advantage few of you have, in that I see every imaginable attempt at building in the country, I have got out what I might term a standard design. I wish this design regarded as more or less a standard in regard to cheap construction for the vary malarious areas, but in addition I am going to point out that it is applicable in other material to barracks in the southern parts.

The time is coming when you will have to employ a certain amount of married labour. It has come on the coal mines. I know a mine that has over 90 per cent married employees, and the recruiter is non est because the mine is able to attract a class of labour because the men can take their wives, and that class is permanent; it stays there. The man who comes with a wife to settle on a place, a respectable type of man, if given a suitable house—something that is really comfortable, especially if it has a hard floor—finds that his good lady takes a fancy to the premises. Her demands for the amenities of the beginnings of civilisation gradually increase, and, so the poor devil has to work his lifetime out to satisfy her demands, and you don't have to drag the territories through with recruiters, as your man is tied to you by a force more potent than even the tax collectors in the Native areas! (Laughter). Now I want to show you how my scheme applies to manual labour. I reckon it never pays any man to try and put more than ten boys into a room. These great barracks where twenty or thirty boys are in a room are all very well, but there is the difficulty of maintaining order. The smaller your accommodation unit the easier it is to handle your boys, because a few friends can get together in one room without strangers. I could not recommend anybody to go over ten for one room.

I have a unit house, which if adapted for single boys holds ten. With a minimum of alteration we can divide it into two rooms each 10 by 15 feet, each capable of holding a married man and his wife, or if you like, a better class of boy. On the same lines with hardly any alteration, we can make it into a two roomed house, and by certain additions to the outside we can make it house either two Indian families or one as the case may be. In addition worked out from the malarious point of view we can mosquito-proof this house with a minimum of netting and without any structural alterations in the walls, and we have provided for all our necessary ventilation; and last but not least in places where it is absolutely impossible to get anything else, we have by the provision of suitable eaves been able to produce a type which will allow walls being built of galvanised iron.

Further we have a building that can be put up in a short space of time with unskilled labour and if ever crowded with temporary labourers it gives them housing of a fairly decent sort for the short period they are picking cotton.

The inside dimensions of this house are 15 x 20. I take 15 as the most satisfactory width because it allows your Natives to sleep feet to feet and gives a reasonable space in the centre as a gangway. You have to give 30 square feet under the regulations, and there is sufficient space between the bunks to get up to the beds in this design and still give them the 30 feet. (The Doctor then proceeded to demonstrate how the building could be adapted to various requirements).

I am advising this type of building because after all you can build it for practically the same cost as you can build a long barrack. These dwellings, put up in rows with a distance of say 15 feet between houses are going to form a very satisfactory form of housing for single boys and they are immediately convertible to married quarters if you want to. I am now going to come to the ventilation because it is very important. I am a great believer in having ventilation under the eaves and high up. If you make your spaces sufficient I am able to count these ventilation spaces as window spaces and cut down the windows. There is a six inch space at the top under the verandah side and the same or a little less at the back. In a malarious area it is a great thing if you can make barracks a mosquito-proof place, without pulling things down.

In building with corrugated asbestos or iron I recommend that the walls be built up on an 8 ft. sheet of iron or asbestos. The wall sheets do not go to the roof. In some situations this would be an excessive amount of ventilation and you can block up as much as you want with 1 ft. strips of corrugated iron. If you want to alter things you have only the 1 ft. strips to take off and not the whole sheet. This barrack as it stands, with gal-

Questions re Labour and Malaria.—Contd.

vanised iron sides, corrugated asbestos roofs and with the verandah will only be sanctioned in the malarious areas where circumstances make it difficult for building in the more permanent substances, and we are not going to permit any variations from the main idea. We are not going to have the eaves lopped off short to save a foot of iron nor are we going to allow minor curtailments. Under the roof you will notice a purlin occurs in such a position above the wall plate that if you tack a ceiling board on it it touches the wall plate and makes it mosquito proof there. These barracks have been very satisfactory in brick. Some have been constructed of ashplate at Colenso and are very satisfactory indeed. The Department will be very pleased to give information about this barrack and Mr. Eadie is arranging that drawings be sent to the Sugar Journal so that you will be able to get full details.

Now the other day I came across an improvement on the plank beds. I had a talk with the local Asbesto Company, Manager and he tells me they will make a sleeping bed of re-inforced asbestos which they guarantee you can jump on, capable of carrying an ordinary heavy Native, and supported only at the two ends. If that can be done you will have a sleeping bed which will be more or less indestructible and will not offer any facilities for vermin, which is a very great consideration.

There is another point, and that is the provision of latrine accommodation. That question I regret to say is again coming to the front. You will remember that many years ago we had "hookworm" in Natal, and it was a very serious thing for the Sugar Industry. I am not a scaremonger but I am sorry to say we are beginning to find a great number of cases of hookworm among the white population in Natal and we are also finding it in the Native Reserve near Port Shepstone. Why Port Shepstone I don't know. It was the very last place that hookworm hung on and it is certainly disquieting to find it among the Natives. In the olden days it was the Indians, now it is the Natives. Further the Natives in the north are fairly well infested with hookworm and always have been. I found hookworm among them in 1910 and they did not get that from the Indians. It has travelled down the East Coast, and the importance of this matter is that you are recruiting Natives from there and some of them have hookworm.

If the stercus from these Natives is allowed to pollute the ground round your barracks all these Natives are going to get it and the infection increases. There is only one way to deal with that and that is to provide latrines, and the Native is a difficult man to handle with regard to that. He has a very reasonable objection to using latrines constructed as most of them have been constructed in the past. As you know the ordinary low class latrine is such a disgusting thing that you can barely expect a Native to use it. Now the great thing is to give him a latrine that will not get dirty, and will not cost much. I have no hesitation in saying that if you are not using an underground supply of water, make a pit latrine.

If you make a pit latrine ten feet deep or more I doubt if you will fill that in as many years, but in making pit latrines you must not go down so far as to run the risk of flooding them; you must not go down to water in the sub-soil. The latrine I advise is a simple decking placed over a hole previously dug, such as this one. (Demonstrates model latrine). There is a point I wish to bring out. Latrines as you know are one of the principal sources of infection of typhoid and one of the most important things is to have a place for your own domestic servants. There are objections occasionally to the smell of a pit latrine. It is nothing like so offensive as that from a bucket. If the light gets into the thing flies are apt to go down and feed on the contents. I was out at Kynochs the other day and they showed me a chemical substance which gives off a gas approximately four or five times heavier than air. I have given some of this chemical to various people down the South Coast and we find that the smell of the stercus at the bottom does not penetrate the gas blanket which forms above it, and if a fly penetrates into the gas it dies.

Mr. G. H. Hulett: With regard to this model building, you say it is to be used only in the northern districts in the malarial district; what objection is there to its being used in non-malarial districts.

Dr. Park Ross: We have to specially arrange our regulations to allow the use of the thing, and I cannot advise that we should put up tin barracks on a big scale round about the southern parts.

Mr. Hulett: Why not on the large sugar estates?

Dr. Park Ross: The Department has carefully gone into this question and while the type and dimensions are considered to be very desirable made in permanent material, temporary material such as iron, can only be sanctioned in exceptional circumstances. The man in the north is situated where he can not get building material.

Mr. Hulett: But it answers the purpose; it is distinguishing between two places.

Dr. Park Ross: It will come to the same thing. There is many a man starting and I know his labour is in grass huts. If the labour on one of the big mills was to be put in grass huts we would have to take steps to stop it. If I dont allow the small man who is starting to put his labour in grass huts what is going to happen. When you get an in

dustry on a fully established basis we expect that industry to establish itself in more or less permanent quarters. I want to get away from this business of building in wattle and daub and all these substitutes.

Chairman: Supposing that system is applied with an inner partition filled in with iron.

Dr. Park Ross: That would do I think, but it would not be so cheap as brick. In any case the man would have to submit his plans. When once you get away from iron you go right into ash or brick.

Mr. Staniland: With regard to the chemical that is suggested for use in latrines, would it have any injurious effect on the man who uses the latrine, as I know of cases where chemicals have been used with very unpleasant effects.

Dr. Park Ross: I have used this chemical myself for the last six months and I am in perfect health.

Mr. Barrett: I want to take this very favourable opportunity of announcing that the Government has appointed two Inspectors of Native Labour for Zululand. (Hear, hear). The appointment has become necessary immediately in view of railway construction in Zululand, but they will interest themselves in labour conditions on sugar and cotton estates as soon as they are able to get about. That holds out one more inducement to you to press on with the amendment of the Labour Act.

I have a word of hope to give, and that is that the new taxation measure which is before Parliament I believe will go a long way towards solving the difficulty of Native registration. Once it is in the interests of the Government to register every Native male for taxation purposes then you have a piece of Government work on which a very sound pass system can be built. (Hear, hear).

There again I would ask those of you who have influence with members of Parliament to press upon them the importance of getting through that taxation measure. It has advantages from the Native point of view, it has great advantages from a revenue point of view, and from the employers point of view if it creates a really sound foundation for a workable registration system which is going to be universal throughout South Africa. It is going to be a tremendous boon to the employer.

Question No. 59.—"What are the advantages, if any, of a standard food scale such as the gold mines adopt, for Native labour on sugar estates keeping in view the idiosyncracies of the Natives themselves, the economic relations of financial success to cost and efficiency on an agricultural proposition and limitations arising from employment of small numbers of men."

Dr. Park Ross: The question of a standard ration for Natives in the Sugar Industry is one which has engaged the attention of the Health Department for a good while, and I think the bulk of the industry are at last coming to be convinced that something better than the usual 3 lbs. of mealie meal is wanted. That three pounds of mealies is a pure waste of mealie meal. No man on earth can use 3 lbs of a carbo-hydrate in his constitution, like mealie meal, so that a certain proportion is wasted, and the proportion that is used is not a proper diet for a man to do a day's work. There is one point: people say "why can't we feed a Native just the same as he lives in his kraal?" The amount of food that will keep a man alive loafing about a kraal is not going to keep him going when he is going to do work on a sugar estate.

The standard I consider necessary for a sugar estate is as set out in the form which I have had printed and which I think the majority of you have already seen. On some estates it has been adopted and on others it has not. One of the objections made is that the Natives won't eat it. That is pure bunkum. The Natives will eat it just as much on the sugar estates as they will on the mines. One of the questions is: is this of practical use to the small employer? I do not think the Native will have any difficulty in cooking his food if issued to him raw and by adopting this ration you ensure that your man is getting sufficient food for a real hard day's work. One item has been the subject of controversy and that is that I recommend fruit. On the mines they get vegetables. Your boys eat cane so we don't worry about vegetables so much. But that does not help with scurvy. The way to prevent scurvy is to give your boys something with a vitamine in it to counteract it. You are having scurvy in a mild form when you begin to get a percentage of your boys going sick with minor injuries. The best thing to do is to go straight to an anti-scorbutic ration. The Zulu does not suffer to the same extent as the imported labour. The Transkei boy comes on the verge of scurvy and unless you give him something to meet it you are going to have trouble.

The Health Department has gone carefully into this ration. With regard to the cost of this ration it was dealt with two years ago I think by Mr. Edwards. I have had a good deal of evidence on the question of cost and where the thing has been intelligently employed everybody has testified that the cost is not much in excess of the present wasteful system of giving three lbs. of mealie meal. The Natives on the Hluhluwe railway construction are all getting this diet and are thriving.

Questions re Labour and Malaria.—Contd.

Question No. 60.—"What steps in the direction of medical examination of labourers recruited for sugar estates are necessary and practicable."

Dr. Park Ross: It is my duty to examine large collections of human weeds at some time or another which are employed by many of you, and there is no doubt about it that there is a tremendous amount of financial waste going on at present owing to your employing labour which is really not fit to work. You would not employ such labour if there was a proper medical examination made of these labourers.

I occasionally hear remarks in connection with boys that I have spoken of disparagingly, that they have all been medically examined in the territories, apparently by the recruiter! Some recruiters will have a proper medical examination made and others will not. It matters not to me where your examination is done, but you can take it from me that it is a very foolish policy to employ any Natives at all unless you are certain that they are thoroughly fit for your work, and you cannot be certain of that unless you have had a proper medical examination made.

Then there is the question as to who is to do that. If you are satisfied with the class of recruit you get from the recruiting agents or your doctors are, well and good; if you are not satisfied or your doctor is not satisfied with them then it is time for you to look into the thing and see that a satisfactory medical report is a condition of recruitment. It is no use, especially with the small recruiter, leaving it to him. I think that every man belonging to the Sugar Association ought to have some cut and dried arrangement that his boys are medically examined either at his place or in Durban or elsewhere, but the essential thing is that the medical man is under some sort of control of the Association.

Mr. G. H. Hulett: Dont you think that each man should have a medical certificate that he is sound. If you take the man on to the estates and your medical man condemns him you have lost all your recruiting fees.

Dr. Park Ross: Is there not such a thing as employing Natives from a recruiter which are subject to return if they don't prove up to standard, the standard being set by some medical man under your control. After all you pay the piper, can't you call the tune?

Mr. G. Hulett: But don't you recommend that every man should be provided with a certificate?

Dr. Park Ross: No, because the medical examination should be under the control of the man who is going to employ the recruits, not the man at the other end. Curious things sometimes happen with recruiters. A medical friend of mine told me that a certain recruiter called on him with reference to the fact that he (the doctor) had rejected thirteen men out of 32, and he said that if a similar thing like that occurred again the medical examination would be passed on to another doctor. That medical man was employed by the recruiter. If he had been employed by the employer that sort of thing would not occur.

Mr. Staniland: I would like the doctor to place himself as far as possible in the position of a planter. The planter requires ten to twenty boys from a recruiter. The planter on his farm knows nothing so to speak, he is dependent on the word he receives from the recruiter, and any medical examination that may be held. All he knows is that they arrive at his place and in a few days he finds half of them are sick. Now the whole burden of the loss is placed on the planter. He is helpless. He cannot be at the depot where the Natives are examined and sent forward. What is to be his position in such a case. Has he any redress? I take it that there is something lacking in this respect.

I think the Government should have a stronger hold on the medical examination of Natives before they are sent to the planter. You may say that if my recruiter does not recruit sound boys then get rid of the recruiter. But we can't do that, we are helpless. The Government takes their licence money, surely the Government should have some claim or hold over them. The Government should not grant them a licence unless they are satisfied that the medical examination of Natives is as it should be.

Dr. Park Ross: I say that the Planters should stick together. What have they Associations for? If they either as an Association or otherwise had control of the doctors who do this job they would get satisfactory men. If they leave things to the recruiters they are going to have trouble. With regard to the Government doing the job I can't see it. If the Planters' Associations ask the Government to allow the District Surgeon to do this examination the Government will say the District Surgeon is only a part time official, and they have not the slightest objection to him making those examination but you will have to pay him. If you like to consider all the District Surgeons as your doctors well and good. If you like to nominate a certain number of doctors to act, you can have control over them, because you would be paying them and the man that pays the fees is the man who calls the tune.

Mr. Barrett: Another advantage in favour of Dr. Park Ross's scheme is that if the medical examination takes place at this end it is better. If the examination takes place in the recruiter's district it is possible for the unscrupulous recruiter to substitute other boys, and there are cases where this has been done.

Questions re Labour and Malaria.—Contd.

Question No. 61.—"In view of the presence of malarial fever in certain portions of the sugar belt, what are the disadvantages, if any, of employing imported labour in those areas and what steps should be taken to overcome the disadvantages."

Dr. Park Ross: At present things are going ahead very rapidly in the North and the question of importation of foreign labour is a very serious problem at these places. The disadvantages of foreign labour are these: in many cases you have not got proper housing for it. The Transkei boy is more susceptible to fever than the local boy. Under the present system of recruiting there is a very large proportion of human weeds finding their way to these districts and the poorer a man is physically the more susceptible is he to malarial fever. A special disadvantage is that in regard to most of the foreign labour going to Zululand or even to Natal, the boys have a feeling that they are away from home and there is a certain amount of nervousness among them. Many of them leave their employment and desert for no real cause. They are far from home and there is not as yet the feeling of security among the imported labour which goes to Natal and Zululand as there is in regard to the Rand.

When a man goes to the Rand he knows from experience practically what he is going to have to put up with. He knows he will be safeguarded, his rations are right, etc. I am asked what special steps should be taken to safeguard imported labour from fever. That is simple and it applies to Natal just the same as Zululand. The one object in avoiding fever in epidemic form is to watch it for early cases of the disease. If you allow one or two or even three cases to occur untended and not looked after on your estates, given that the weather conditions are favourable you can confidently expect to see fever in epidemic form in ten to fourteen days after these cases. If the early cases are taken and put under treatment at once you have every likelihood of escaping fever in epidemic form, and after all the avoidance of fever in epidemic form is the economic factor you want. With regard to general measures to be taken, if there is any suspicion of fever I recommend prophylactic quinine right off. I recommend the smoking of barracks and further, an oil smear for the boys to rub on their bodies. There is a good preparation made by Allen & Hanburys. With regard to this early diagnosis, we have made the offer before and it is always open, that if you or your doctors are suspicious of fever you have only to take blood smears and send to the Government Laboratory, and the results if positive will be communicated to you by telegram. That is a free offer which still stands.

The year before last I prophesied fever in December; it came in February. This year I was certain that before the last rains began we were in for an epidemic in the North. There were a few cases when I was up there in February, and cases suddenly began to appear in alarming frequency in the week I was up there around Hluhluwe. I prophesied an epidemic unless something happened. Something did happen alright, we got this heavy rain. If we get the cold weather soon we will probably not have an epidemic. But I advise you to keep a look out all the same.

On the next page is a summary of Dr. Park Ross's contribution to the Congress. It is reproduced in this form in order to simplify reference to the diagrams and model that the speaker exhibited.

At the conclusion of the Conference the Chairman expressed on behalf of the members their thanks to the various Government officials who had been so ready to assist in connection with the whole congress. He also thanked the Press for their attendance and the reports of the proceedings which had been inserted also the Experiment Station officials and the Secretary, for their help and the manner in which the whole of the proceedings had been organised. The Chairman also expressed their thanks to the Town Council for the use of the Council room. (Applause).

LUNCHEON AT THE ROYAL HOTEL.

On the last day of the Congress Mr. Edward Saunders, chairman of the day, entertained a select gathering consisting of the Government officials present at the Congress, the hosts of the preceding two days, the representatives of the Press, members of the Executive Council of the South African Sugar Association and officials of the principal sections of the Sugar Industry, to a special luncheon at the Royal Hotel.

The proceedings were very animated and cheerful, and owing to the short time at their disposal there were no special speeches.

The usual loyal toast having been honoured, the chairman, Mr. Edward Saunders, in a few brief words, expressed thanks to all who had assisted in making the Congress a success, and particularly mentioned the Government technologists, without whose valuable advice and assistance the functions would have been deprived of a great deal of their value.

Mr. Fisher in acknowledging the toast emphasised the pleasure it gave to the Government officials to attend these Congresses, and urged that they were always glad to hear from planters at any time and to help them with their problems. He thanked the chairman for his very kind expressions regarding himself and his colleagues and he assured them that they were just trying to do their duty and that they would use every endeavour to push forward agriculture in the country.

A Standard House Plan for Coloured Labour and Details of its Conversion to Mosquito-Proof Quarters.

(By G. A. PARK ROSS M.D., D.P.H., Official Health Officer for the Union of South Africa.)

The advantages of good housing need no endorsement from me. They are apparent to every employer who is out not only to do his best for the health of his employees, but is anxious to have them contented by making their housing attractive.

Recruiting fees represent the heaviest unproductive expenditure in connection with labour. Good housing tends to eliminate the recruiter and has actually secured his total disappearance on certain properties, where married labour, attracted by the houses, has replaced single labour. It has been found that £30 spent on the housing of a married man is a better investment than the £6 required to provide accommodation in barrack form for single men.

I think that barrack buildings for single men on estates, or even on mines with plenty space available, is bad finance. None of us know what our future labour is going to be. The conventional rows of rooms accommodating 12 or more single labourers are convertible to nothing else. Married Natives will not live in them under any circumstances. Indians will live in terraces but they, like married Natives, much prefer self-contained houses.

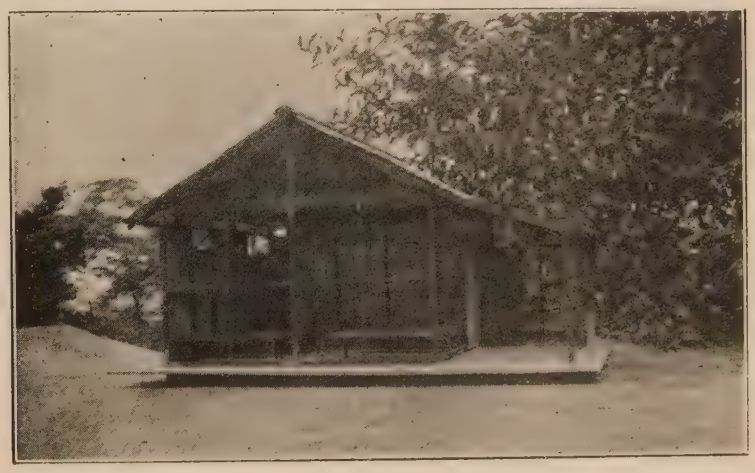
Single Natives are not so particular but show a preference for small rooms occupied by a few friends.

It is just as easy, and almost as cheap to erect single-roomed houses as ranges of barracks, and I have got out a design which I recommend as a unit plan. With certain minor modifications this can be used as:—

1. A one room dwelling for 10 single labourers.
2. Two one-roomed dwellings.
3. A two-roomed self-contained house.
4. A second arrangement of the two-roomed house.

This plan is quite successful in brick or in ash-plate, under tile or under iron. Its essentials are:—

(a) An inside dimension of 20 ft. x 15 ft.
(b) Hardened floors.
(c) A wall height of 8 ft. 6 ins. minimum.
(d) Ventilation under the wall plate which counts as window space.



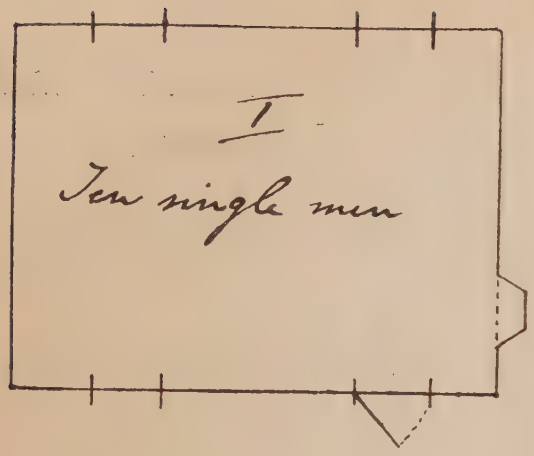
View of the house with one end removed to demonstrate the style of the interior.

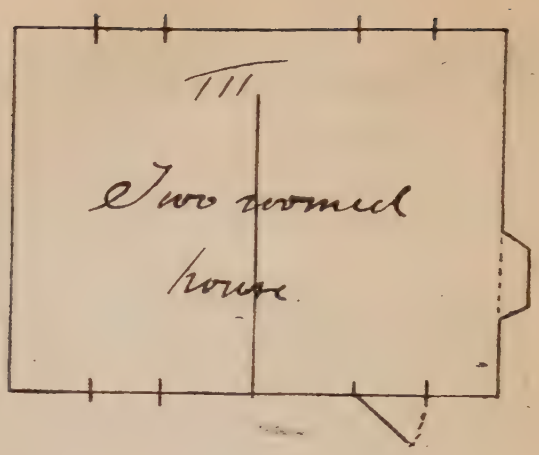
(e) A heavy overhang on eaves not only to shade walls, but to shelter the ample ventilation spaces.

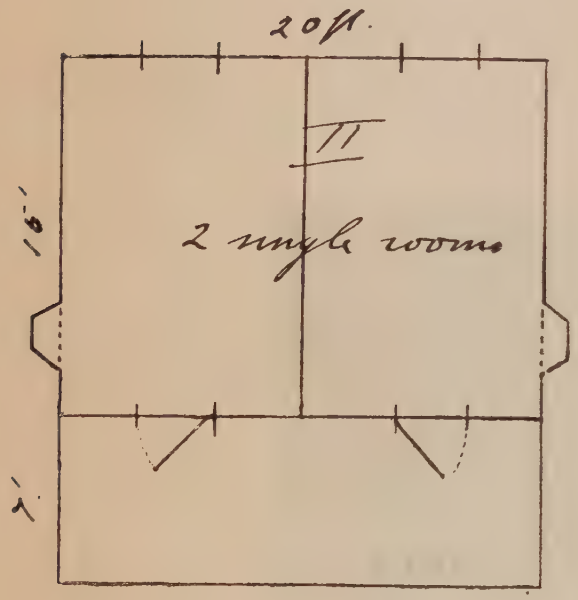
Fireplaces are optional, but except for the special design for malarious places hereafter set out fireholes in the floor are inadmissable. Proper fireplaces can easily be provided and if details as to purlins, vent openings, etc., as set out in the special design are attended to, mosquito-proofing is easy and economical.

I invite attention to the floor-plan, and its modifications, as shown in the diagrams.

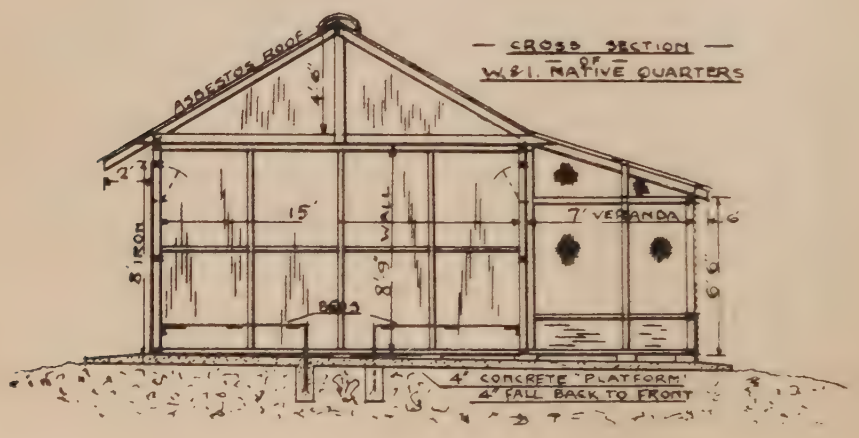
It will be seen that starting with plan (1) for single Natives, conversion to any others, or reversion back to the original is simplicity itself.


I
Ten single men


III
Two roomed
house


20ft.
II
2 single rooms
16'
7'

IV
Two roomed
house


— CROSS SECTION —
OF
W & I. NATIVE QUARTERS
ASBESTOS ROOF
4'6"
2'3"
15'
8'9" WALL
7' VERANDA
8' IRON
BOND
4' CONCRETE PLATFORM
4" FALL BACK TO FRONT

A Standard House Plan for Coloured Labour.—Contd.

For many parts of Natal and Zululand a barrack which can easily be made mosquito-proof is desirable.

It is not general practice as yet to go in for mosquito-proofing but it may become necessary in the future especially for the accommodation of labour from healthy places.

The adaptation of existing barracks to mosquito-proof construction will in most cases prove costly, but if the eventual proofing of buildings is kept in mind from the outset and dwellings constructed on the lines indicated, the intial cost is no more and the additional expense for netting comparatively low.

In mosquito-proofing a few points must be kept in mind:—

(a) There must be a verandah of ample size under gauze. Unless this is provided Natives will not stay in after sundown. Where there is a good verandah it becomes the popular living room and the gauze does not get damaged if details specified are followed.

(b) The purlins and vent-openings must be properly arranged to allow easy blocking up with netting or wood.

(c) The aspect should be S. — S.E. to allow of the free use of the verandah even on rainy nights with driving wind, and it is as well to block up with iron or other material the west end, if not both ends, of the verandah.

(d) Gauze must be kept down to a minimum.

(e) Fires may be permitted inside and on the verandah for the sake of the smoke.

In Natal and Zululand we not only have a malarious climate, but a lack of building material, as brick, etc. Further the cotton industry in particular bids fair to require a labour supply liable to considerable fluctuations, and at picking season while there is still a risk of malaria there will be a heavy demand for accommodation.

Special Type for Malarious Places.

To meet this I have designed a house which is cheap to construct, absolutely mosquito-proof, and which will allow of some crowding up at rush periods without undue detriment to the health of the inmates, and I set out the design hereunder See diagram v.

It must be understood, however, that under the Natal Regulations 659 of 16/6/15 the sanctioning of barrack schemes is in the hands of the Minister and that no departures from this plan will be sanctioned.

The above is a special design for special circumstances and its constructional details have been carefully worked out to give the maximum accommodation on a minimum of cost.

Iron is only sanctioned when nothing better is available, and the eaves are set out to shade this iron and the vent openings, which count as windows.

The essence of the design is that there is a double wall plate and the wall iron reaches only to the lower one. Gauze goes on outside. If ventilation is too brisk a 1 ft. iron strip is put on above the wall iron and between wall plates. Note position of purlins over wall plates. They are there to allow of easy blocking of space between roof corrugations and wall plate, but these must of course be packed with tow above the purlins.

The verandah must face S.—S.E. and it should have both ends blocked up to be used for extra labour to sleep on and as the living room of the house at other times.

This house can be adapted to the same uses as the others—see diagrams i - iv and is shown in elevation in diagram v. I also attach a photo of a model of this building together with specification.

A Standard House Plan for Coloured Labour.—Contd.

Specification of New Type of Native Quarters for Malarious Areas.

Framing. — Of deal, corner and partion posts and plates 3'' x 3'' remainder 2'' x 3''.

Walls.—8' 9'' high covered outside with 8' galvanised corrugated iron 24G, 6'' clear opening above back wall. Iron to be closed with iron 12'' long which may be replaced with gauze at any time: front to be open.

Roof.—Gable type: framing of deal 1½'' x 4½'' covered with corrugated asbestos with tile ridging. Alternatively, roof may be covered with galvanised corrugated iron with 4'' thatch on purlins superimposed thereon. No gutters required.

Verandah.—On front only: deal framing, plates 3'' x 3'', rails 2'' x 3'', corner posts 3'' x 4½'' front posts 2'' x 4½'' ends posts 2'' x 3'': Wire gauze to be applied above mid-rail and galvanised corrugated iron horizontally laid below to render building mosquito proof.

Doors.—One 3' x 6'4'' stable type, batten door required if building arranged as one room shown on diagram v; two for building with cross partition; doors open out and no frames necessary: planted on stops used.

Windows.—Four stock 3' x 16'' x 1½'' fanlights to open in without frames—stops as for doors: check chains and turn-button to each light.

Floor.—Of concrete or similar impermeable material. Fire-holes and falls as and where shown and outside run off or shallow gutter as desired.

Beds.—Constructed to five boards laid with ½'' space between and battened. Size 2'6'' x 6'; beds carried on 2'' x 4½'' head rail spiked to wall and 1½'' steel angle rail at foot supported by legs of same material grouted into concrete floor: hanging rail of ½ tube for clothes, etc. to be arranged on walls over beds.

Finish.—All framing and other timber, except joinery, to be in the rough and all treated with preservative.

Sites.—Frontage S. to S.E. aspect: weather end of verandah may be closed in. Alternative sites may face N.W.

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